

Epidemic Intelligence Service (EIS) Conference

UNITED IN SERVICE

May 2–5, 2022


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2022 Epidemic Intelligence Service (EIS) Conference

May 2–5, 2022

Agenda-at-a-Glance

Monday	WELCOME AND CALL TO ORDER 11:30–12:00 pm
	 SESSION A: Stephen B. Thacker Opening Session 12:00–1:45 pm
	BREAK 1:45–2:15 pm
	CONCURRENT SESSION B1: Social and Health Inequity 2:15–3:40 pm
	CONCURRENT SESSION B2: Pregnancy, Childhood, and Adolescence 2:15–3:40 pm
	CONCURRENT SESSION B3: COVID-19-Associated Outcomes 2:15–3:40 pm
	BREAK 3:40–4:10 pm
	SESSION C: J. Virgil Peavy Memorial Award Finalists 4:10–5:35 pm
	BREAK 5:35–6:00 pm
	EIS Alumni Association Meeting (private event sponsored by EISAA) 6:00–7:30 pm
Tuesday	CONCURRENT SESSION D1: Global Health 11:30–12:55 pm
	CONCURRENT SESSION D2: COVID-19 Diagnostics and Testing 11:30–12:55 pm
	CONCURRENT SESSION D3: Nutrition, Physical Activity, and Obesity 11:30–12:55 pm
	BREAK 12:55–1:25 pm
	SESSION E: Donald C. Mackel Memorial Award Finalists 1:25–2:50 pm
	BREAK 2:50–3:20 pm
	SESSION F1: Environmental and Occupational Health 3:20–5:05 pm
	SESSION F2: Migrant, Refugee, and Traveler Health 3:20–5:05 pm
	SESSION F3: Benefits of COVID-19 Vaccination 3:20–5:05 pm
	VIRTUAL PREDICTION RUN (Sponsored by EIS Alumni Association) 6:00 pm
Wednesday	CONCURRENT SESSION G1: One Health: Pandemic, Prevention, and Plague 11:30–12:55 pm
	CONCURRENT SESSION G2: Vaccine-Preventable and Respiratory Diseases 11:30–12:55 pm
	CONCURRENT SESSION G3: HIV and STDs 11:30–12:55 am
	BREAK 12:55–1:25 pm
	 SESSION H: Alexander D. Langmuir Lecture 1:25–2:45 pm
	BREAK 2:45–3:15 pm
	CONCURRENT SESSION I1: Infections in Healthcare Settings 3:15–4:40 pm
	CONCURRENT SESSION I2: Recreational Risks 3:15–4:40 pm
	CONCURRENT SESSION I3: Chronic Disease and Emergency Preparedness 3:15–4:40 pm
	Thursday
CONCURRENT SESSION J2: Notes from the Field 11:30–12:55 pm	
CONCURRENT SESSION J3: Tuberculosis 11:30–12:55 pm	
BREAK 12:55–1:25 pm	
CONCURRENT SESSION K1: Global Pandemic Response and Impacts 1:25–2:50 pm	
CONCURRENT SESSION K2: Vector-Borne Diseases 1:25–2:50 pm	
CONCURRENT SESSION K3: Waterborne Diseases 1:25–2:50 pm	
BREAK 2:50–3:20 pm	
SESSION L: Late-Breaking Reports 3:20–4:25 pm	
 PRESENTATION OF AWARDS 4:25–4:35 pm	
CLOSING REMARKS 4:35–4:45 pm	
POST-CONFERENCE EIS SATIRICAL REVIEW 7:30 pm	
 <i>Awards presented during session.</i>	

Disclaimer: The findings and conclusions of the reports presented at the 2022 EIS Conference are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC). Use of trade names and commercial sources is for identification only and does not imply endorsement by the Division of Scientific Education and Professional Development; Center for Surveillance, Epidemiology, and Laboratory Services; CDC; the Public Health Service; or the U.S. Department of Health and Human Services. Published May 2022.

EIS 2022

THE
CDC
FIELD EPIDEMIOLOGY
MANUAL

EDITED BY
SONIA A. RASMUSSEN
AND RICHARD A. COOPER

-NAME COLOR KEY-



EIS & LLS
Alumni



Current
EIS Officers
& LLS Fellows



Incoming
EIS Officers
& LLS Fellows



Prospective
EIS Officers
& LLS Fellows



Conference
Participants



Conference
Staff



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Media

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70TH EIS NFERENCE

April 24-27th, 2023

MEDIA

IF YOU WOULD LIKE TO SPEAK WITH ANY OF THE CONFERENCE PRESENTERS, CONTACT:

MELISSA BROWER
EIS Public Affairs
Call/text: 404-903-0241
Email: ggek5@cdc.gov



EIS  **2022**

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🏆 *Awards presented during session.*

Preface

Dear Conference Participants,

Welcome to the first ever virtual EIS conference. For the past 2 years, we were unable to host the conference because EIS officers, their supervisors, and likely anyone reading this was fully engaged in the pandemic response. While the pandemic is not over, we are resuming critical training elements of the EIS program. EIS conference is a foundational training opportunity for officers to refine their skills with communicating scientific information; for attendees to learn from and ask challenging questions about EIS officer investigations and analyses; and for EIS officers, alumni, CDC staff, and the public health community to come together and exchange ideas around the practice of consequential epidemiology. We are grateful you can join us for the conference.

Like everyone in public health, the EIS program has faced unprecedented challenges during the pandemic. We are especially proud of our graduating class of officers. They started EIS by relocating to new cities during the pandemic. They had limited opportunities to build professional or personal support systems. They began deploying immediately and deployed again and again in support of the pandemic response. Our officers have gained invaluable experience while building on the EIS legacy of service and the practice of consequential epidemiology. This conference features 106 presentations of our officers' work on topics ranging from chronic disease prevention, injuries and violence, environmental health, occupational health, and infectious diseases including COVID-19.

As part of CDC's investment in strengthening the public health workforce, we have received additional funds to expand the size of EIS and the Laboratory Leadership Service (LLS). We are preparing to welcome the largest EIS and LLS classes in the history of the programs. The incoming EIS class of 2022 includes 89 officers and the LLS 25 fellows. The incoming classes will benefit from a return to in-person training, CDC's data modernization initiative, and the EIS program's diversity, equity, inclusion, and accessibility (DEIA) initiative.

The EIS program is infusing DEIA principles in all elements of our program. Our Langmuir Lecturer, Dr. Mary Bassett, will challenge us to think about the intersection of race, racism, and public health. Guided by the EIS DEIA Council formed in 2021, we are changing how we recruit, select, train, and support our officers. For example, we now offer two series of webinars on the "EIS experience" and "tips for applying to EIS." The webinars are designed to make the program more accessible to applicants and to ultimately improve the diversity of people applying and selected for the program. EIS alumni go on to assume key leadership positions so a more diverse EIS program will lead to more diverse leadership at CDC and state and local health departments.

We appreciate you making time to participate in the 2022 EIS virtual conference. You are contributing to the training of CDC's Disease Detectives by asking challenging questions of our presenting officers. We hope you learn something new that either makes you more effective at your job or informs your career progression. We hope to see you at an in-person EIS conference in 2023!

Respectfully,



Eric Pevzner



Beth Lee

Chief and Deputy Chief of the Epidemiology Workforce Branch,
Epidemic Intelligence Service

EIS Alumni Association

The EIS Alumni Association (EISAA) represents more than 4,000 alumni working on the front lines of public health at local, state, federal, and global levels, both public and private sectors. The association was first established in the 1960s by a group of alumni interested in fostering a sense of loyalty to the EIS program. The mission of EISAA is to foster and sustain a sense of collegiality among its members and to promote the welfare of the EIS Program. The EISAA sponsors several prestigious awards, hosts alumni networking events, and carries on treasured EIS traditions throughout conference week.

The EIS Alumni Association, in partnership with the CDC Foundation, awards the *Alexander D. Langmuir Prize*, named in honor of the beloved founder of the EIS; and the *Stephen B. Thacker Excellence in Mentoring Award* initiated in 2013 in honor of Dr. Steven Thacker, an inspirational leader who championed the EIS program and its officers throughout his career.

In addition, the EISAA helps support the *Distinguished Friend of EIS Award* honoring an individual who has provided exceptional support to EIS Program; the *J. Virgil Peavy Memorial Award* named in honor of a distinguished CDC statistician and EIS mentor; the *Philip S. Brachman Award*, named in honor of the distinguished director of the EIS (1970-1981); and the *Outstanding Poster Presentation Award*.

Each year, EISAA also provides competitive travel scholarships for prospective applicants to attend the EIS Conference through the *David J. Sencer Scholarship Award*. EISAA also helps support EIS Conference events such as the *Prediction Run* and *Skit Night*.

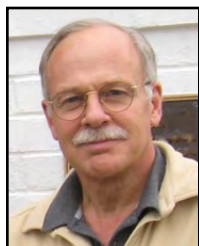
EISAA has a **user-friendly website** (www.eisalumni.org) and alumni portal that allows EIS alumni and current officers to find each other and connect based on geographic location or interest. The EISAA also **mobilizes broader recruitment support** for the EIS program by assisting with the development of new recruitment materials, sponsoring regional recruitment events, and utilizing our diverse alumni pool to speak at local residencies, academic institutions, and national conferences. In the past two years, EISAA has supported the priority within CDC to **promote diversity, equity, inclusion (DEI), accessibility, and belonging**, including working with alumni help recruit a diverse pool of qualified candidates for the EIS program.

If you haven't already made a contribution to EISAA this year, please consider doing so TODAY! Here's how you can get involved:

- **Support the EISAA Now!** You can pay your dues and make a contribution to the EIS Fund online at www.eisalumni.org. Recurring donation and planned giving options such as payments from donor-directed funds are available!
- **Stay Connected!** If you are an EIS alumnus/ae and need login instructions for the alumni portal, please email to eisalumni@cdcfoundation.org. This information will guide you on how to log-on to the password protected alumni portal and update your contact information and alumni profile.
- **Learn More!** Join us for our virtual Annual meeting on Monday, May 2, 2022 at 5:30 p.m. ET.

EISAA is driven by an important purpose — to bring alumni and friends together to connect professionally and personally. We hope you will join us in building our alumni community and supporting the premier public health training program in the world!

Sincerely,



Gus Birkhead, MD, MPH, EIS '85
President, EIS Alumni Association



Diana Robelotto Scalera
Director of Alumni Affairs/EISAA Liaison, CDC Foundation

2022 Scientific Planning Committee



Virginia Bowen



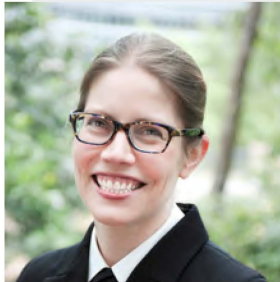
Jennifer Liang



Jennifer Wright



Michelle Hughes



Laura Cooley



Jennifer Cope



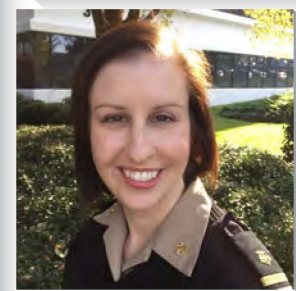
Kevin Clarke



Ethan Fechter-Leggett



Julia Gargano



Brooke Hoots



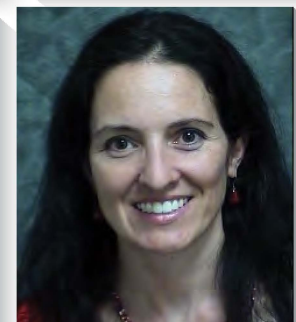
Xia Michelle Lin



Sharyn Parks Brown



Duong (Tony) Nguyen



Maria Mirabelli

Virginia Bowen • Co-Chair
Administration for Children & Families,
U.S. Department of Health & Human Services

Jennifer Liang • Co-Chair
Center for Surveillance, Epidemiology, and Laboratory Services

Jennifer Wright
Center for Surveillance, Epidemiology, and Laboratory Services;
Epidemiology Workforce Branch-Field

Michelle Hughes
National Center on Birth Defects and Developmental Disabilities

Laura Cooley
National Center for HIV/AIDS, Viral Hepatitis,
STD and TB Prevention

Jennifer Cope
National Center for Emerging and Zoonotic Infectious Disease

Kevin Clarke
Center for Global Health

Ethan Fechter-Leggett
National Institute for Occupational Safety and Health

Julia Gargano
National Center for Immunization and Respiratory Diseases

Brooke Hoots
National Center for Injury Prevention and Control

Xia Michelle Lin
Center for Surveillance, Epidemiology, and Laboratory Services

Sharyn Parks Brown
National Center for Chronic Disease Prevention
and Health Promotion

Duong (Tony) Nguyen
National Center for Health Statistics

Maria Mirabelli
National Center for Environmental Health/Agency
for Toxic Substances and Disease Registry

Virginia Bowen • Jennifer Liang
Office of Minority Health and Health Equity

General Information

Program Production

- EIS Program
- On Par Productions, LLC

Acknowledgments/Disclaimers

The EIS Program extends a special thank you to the EIS Alumni Association and the Council of State and Territorial Epidemiologists for their generous support of the 2022 Annual EIS Conference. The EIS Program gratefully acknowledges the valuable assistance and cooperation of the editorial and support staff of all CDC administrative units participating in the EIS Conference.

Abstracts in this publication were edited and officially cleared by the respective national centers. Therefore, the EIS Program is not responsible for the content, internal consistency, or editorial quality of this material. Use of trade names throughout this publication is for identification only and does not imply endorsement by the U.S. Public Health Service or the U.S. Department of Health and Human Services.

The findings and conclusions in these reports are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Purpose Statement

The primary purpose of the EIS Conference is to provide a forum for EIS officers to deliver scientific presentations (oral or poster), increase their knowledge of recent investigations and the significance to public health, and maintain and increase their skills in determining the appropriateness of epidemiologic methods, presenting and interpreting results clearly, and developing appropriate conclusions and recommendations.

Overall Conference Goals

- To provide a forum for EIS officers, alumni, and other public health professionals to engage in the scientific exchange of current epidemiologic topics
- To highlight the breadth of epidemiologic investigations at CDC
- To provide a venue for recruitment of EIS graduates into leadership positions at CDC and state and local departments of health



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2022 Annual EIS Conference Schedule

Monday, May 2, 2022

- 7:00 **Registration Desk Opens**
- 8:15 **Welcome and Call to Order**
Rochelle Walensky, CDC Director
Eric Pevzner, EIS Program Chief
Evelyn Twentyman, EIS Alumni Association President-elect
Maria Thacker, daughter of Stephen B. Thacker, EIS '76
- 🏆 **Presentation of Stephen B. Thacker Excellence in Mentoring Award**
- 12:00–1:45 🏆 **SESSION A: Stephen B. Thacker Opening Session**
Moderators: Leslie Dauphin and Patricia Simone
- 12:05 SARS-CoV-2 Outbreak Among a Highly Vaccinated Population at a Federal Correctional Facility — Texas, July–August 2021. *David W. McCormick*
- 12:25 Translocation of a Rabid Anteater Resulting in Multiple Human Exposures — Tennessee, 2021. *Heather N. Grome*
- 12:45 Elevated Respirable Crystalline Silica Exposure Among Engineered Stone Fabrication Workers — California, January 2019–February 2020. *Krishna Surasi*
- 1:05 Long-Term Symptoms by Demographic Characteristics and Underlying Chronic Conditions Among Adults Tested for SARS-CoV-2 — United States, 2020–2021. *Emma K. Accorsi*
- 1:25 Spinal and Disseminated Tuberculosis Caused by Surgical Implantation of a Bone Tissue Product — 20 U.S. States, 2021. *Alfonso C. Hernandez-Romieu*
- 1:45 **BREAK**
- 2:15–3:40 **CONCURRENT SESSION B1: Social and Health Inequity**
Introduction: Leandris Liburd
Moderator: Brooke Hoots
- 2:20 HIV Outbreak Among People Who Inject Drugs — Kanawha County, West Virginia, 2019–2021. *Rebecca B. Hershov*
- 2:40 Homicides of Black Males Across the Lifespan: Findings from the National Violent Death Reporting System — 2003–2019. *Miriam E. Van Dyke*
- 3:00 Impact of Pneumococcal Conjugate Vaccines on Differences in Invasive Pneumococcal Disease Between Black and White Persons — United States, 2008–2019. *Emma K. Accorsi*
- 3:20 Barriers to Healthcare Access Among Women Diagnosed with Invasive Cervical Cancer, Human Papillomavirus Vaccine Impact Monitoring Project (HPV-IMPACT) — United States, 2008–2020. *Hannah G. Rosenblum*
- 2:15–3:40 **CONCURRENT SESSION B2: Pregnancy, Childhood, and Adolescence**
Introduction: Karen Remley
Moderator: Michelle Hughes
- 2:20 Alcohol Consumption Among Pregnant People Aged 18–49 Years — United States, 2018–2020.

🏆 *Awards presented during session.*

Lucas K. Gosdin

2:40 Clusters of SARS-CoV-2 Infection Associated with K-12 Public School Settings — Wyoming, August 1, 2020–May 31, 2021. *Christine J. Atherstone*

3:00 Immunogenicity of Quadrivalent Human Papillomavirus Vaccine Among Alaska Native Children Aged 9–14 Years at 5 Years After Vaccination — Alaska, 2011–2019. *Bionca M. Davis*

3:20 Rapid Onset of Functional Tic-Like Behaviors Among Adolescent Girls — Minnesota, September–November 2021. *Melanie J. Firestone*

2:15–3:40 CONCURRENT SESSION B3: COVID-19-Associated Outcomes

Introduction: Barbara Mahon

Moderator: Kris Bisgard

2:20 Health Outcomes After Hospital Discharge and Response to COVID-19 Vaccination in Children with a History of Multisystem Inflammatory Syndrome — United States, 2020–2021. *Amber Kunkel*

2:40 Post-COVID Condition Symptom Clusters and Associations with Return to Pre-COVID Health — Results from a 2021 Multi-State Survey. *Stacey L. Konkle*

3:00 COVID-19 Mortality Surveillance Using Death Certificates and Time Elapsed Between Positive Molecular Test and Death — California, June 2021. *J. Bradford H. Bertumen*

3:20 COVID-19–Associated Mucormycosis — Arkansas, July–September 2021. *Theresa M. Dulski*

3:40 BREAK

4:10–5:35 SESSION C: J. Virgil Peavy Memorial Award Finalists

Introduction: Daniel Jernigan

Moderator: Byron Robinson

4:15 Effectiveness of Pfizer-BioNTech COVID-19 Vaccine to Prevent SARS-CoV-2 Infection Among Long-Term Care Facility Staff With and Without Prior Infection — New York City, January–June 2021. *Kathryn Peebles*

4:35 Health Disparities in Coccidioidomycosis Incidence — California, 2000–2019. *Marisa A.P. Donnelly*

4:55 Predictors of Increased Correlation Between Community COVID-19 Cases and SARS-CoV-2 Wastewater Concentrations in Wisconsin — January–October 2021. *Peter M. DeJonge*

5:15 A Masked Decrease in Incidence of *Campylobacter* Infections and Increasing Resistance to Antibiotics Used to Treat Severe Infections — United States, 2005–2018. *Laura Ford*

5:35 BREAK

6:00–7:30 EIS ALUMNI ASSOCIATION MEETING (private event sponsored by EISAA)

Tuesday, May 3, 2022

11:30–12:55 CONCURRENT SESSION D1: Global Health

Introduction: Kevin Cain

Moderator: Kevin Clarke

11:35 Strong Father-Child Relationships Moderate the Association Between Adverse Childhood Experiences and HIV Acquisition Risk Among Young Women — Namibia, 2019. *Nickolas T. Agathis*

11:55 Animal Exposures Associated with Acute Febrile Illness — Bangladesh, 2019–2020. *Rewa Choudhary*

12:15 Trends in Insecticide-Treated Net Indices and Effect on Community Malaria Prevalence — Western Kenya, 2015–2020. *Julia M. Janssen*

12:35 Marburg Hemorrhagic Fever: Investigating West Africa's First Outbreak, and Preparing for the Next — August–September, 2021. *Jason Malenfant*

11:30–12:55 CONCURRENT SESSION D2: COVID-19 Diagnostics and Testing

Introduction: Michael Iademarco

Moderators: Emily Jentes

- 11:35 Field Evaluation of an At-Home SARS-CoV-2 Rapid Antigen Test — Wisconsin, August 2–October 14, 2021. *Hannah E. Segaloff*
- 11:55 Abbott BinaxNOW Performance During SARS-CoV-2 B.1.617.2 (Delta) Variant Predominance — Utah, June 2–August 25, 2021. *Jack A. Pfeiffer*
- 12:15 Testing Outcomes and Student Adherence from an Antigen-based Testing Algorithm in a University Setting, Wisconsin — October–November 2020. *John Paul Bigouette*
- 12:35 Comparison of the ID NOW™ COVID-19 Assay at Point-of-Care to Laboratory-Based NAATs — Washington DC, 2020–2021. *David E. Payne*

11:30–12:55 CONCURRENT SESSION D3: Nutrition, Physical Activity, and Obesity

Introduction: Celeste Philip

Moderator: Sharyn Parks Brown

- 11:35 Comfort Eating and the COVID-19 Pandemic: Was Taking Comfort by Eating in Response to Stress and Loneliness Associated with Weight Changes? *David J. Ederer*
- 11:55 Obesity is Associated with a Higher Risk of Death Among Patients with COVID-19 Aged 20–50 Years — Florida, 2020–2021. *Emily N. Schmitt-Matzen*
- 12:15 Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Support and Early Introduction of Infant Cereal, WIC Infant and Toddler Feeding Practices Study-2 — United States, 2013–2014. *Kristin J. Marks*
- 12:35 Participation and Intention to Use New Places and Changed Spaces for Physical Activity During the COVID-19 Pandemic — United States, 2021. *Bryant J. Webber*

12:55 BREAK

1:25–2:50 SESSION E: Donald C. Mackel Memorial Award Finalists

Introduction: Leslie Dauphin

Moderator: Tara Henning

- 1:30 Clarifying Transmission Chains in a Workplace, School, and Fitness Center COVID-19 Cluster — Connecticut, 2020. *Stephen M. Bart*
- 1:50 Use of Rapid Genomic Sequencing and Vaccine Effectiveness to Assess Vaccine Match Against a New Subgroup of Influenza A(H3N2) Viruses — Michigan, 2021. *Miranda J. Delahoy*
- 2:10 Campylobacteriosis Outbreak Linked to Municipal Water — Nebraska, 2021. *Lauren C. Jansen*
- 2:30 Imported Aromatherapy Spray Associated Multi-State Outbreak of Melioidosis — Georgia, Kansas, Minnesota, Texas, 2021. *Julia K. Petras*

2:50 BREAK

3:20–5:05 SESSION F1: Environmental and Occupational Health

Introduction: Patrick Breyse

Moderator: Maria Mirabelli

- 3:25 Assessing the Human Health Impact of an Industrial Facility Fire — Winnebago County, Illinois; June–July 2021. *Jasmine Y. Nakayama*
- 3:45 An Evaluation of the National Environmental Public Health Tracking Network as a Surveillance Tool for Radon Testing. *Alyssa N. Troeschel*

-
- 4:05 Occupational and Workplace Factors Associated with SARS-CoV-2 Infection Based on Serologic Status Among Blood Donors — July 2021–November 2021. *Melisa M. Shah*
 - 4:25 Mitigating an Unknown Threat: Acute Nonviral Hepatitis Linked to a Brand of Alkaline Bottled Water — Nevada and California, 2020. *Jeanne Ruff*
 - 4:45 Childhood Blood Lead Testing Before the COVID-19 Pandemic, During Peak COVID Surge, and During Recent Months — Chicago, 2020–2021. *Hillary Spencer*

3:20–5:05 SESSION F2: Migrant, Refugee, and Traveler Health

Introduction: Clive Brown

Moderator: Virginia Bowen

- 3:25 Investigation of Two Travel-Associated Cases of Monkeypox — Texas and Maryland, 2021. *Faisal S. Minhaj*
- 3:45 Farmworker Mobility and COVID-19 Vaccination Strategies — Yuma County, Arizona, 2021. *Katherine A. Franc*
- 4:05 Multistate Nontyphoidal *Salmonella* and Shiga Toxin-Producing *Escherichia coli* Outbreak Investigations Linked to International Travel — United States, 2017–2020. *Caroline A. Habrun*
- 4:25 Refugee Outreach Unit Formation for the COVID-19 Response — Maricopa County, Arizona, January 2020–November 2021. *Ariella P. Dale*
- 4:45 Falsification of Travel-Required COVID-19 Laboratory Reports — United States Virgin Islands, March–April 2021. *Valerie V. Mac*

3:20–5:05 SESSION F3: Benefits of COVID-19 Vaccination

Introduction: Amanda Cohn

Moderator: Larry Cohen

- 3:25 Effectiveness of COVID-19 Vaccines Against Symptomatic Infection by Time Since Vaccination Before and During Delta Variant Predominance — United States, March 13, 2021–October 17, 2021. *Amadea K. Britton*
- 3:45 Differences in Anti-SARS-CoV-2 Antibody Levels Among University Students Vaccinated with U.S. Domestic and International COVID-19 Vaccinations — Madison, Wisconsin, September 2021. *Peter M. DeJonge*
- 4:05 Primary and Secondary Attack Rates by Vaccination Status After a SARS-CoV-2 Delta Variant Outbreak at a Youth Summer Camp — Texas, June 2021. *Julia M. Baker*
- 4:25 The Effect of Student COVID-19 Vaccination Coverage on Case Rates in New Jersey Middle and High Schools — Fall 2021. *Reed Magleby*
- 4:45 Characterization of COVID-19-Associated Deaths During the SARS-CoV-2 Delta Variant Surge Among Adults Aged 20–49 — Kentucky, July 1–August 13, 2021. *Alyson M. Cavanaugh*

6:00 VIRTUAL PREDICTION RUN (Sponsored by EIS Alumni Association)

Wednesday, May 4, 2022

11:30–12:55 CONCURRENT SESSION G1: One Health: Pandemic, Prevention, and Plague

Introduction: Casey Barton Behravesh

Moderator: Jennifer Wright

- 11:35 SARS-CoV-2 Outbreak Involving Malayan Tigers and Humans — Tennessee, 2020. *Heather N. Grome*
- 11:55 Dog Bite-Related Emergency Department Visits and Time-Sensitive Emergency Registry Records — Idaho, January 2017–October 2021. *Megan E. Cahill*

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- 12:15 Rabies Postexposure Prophylaxis Surveillance System: A Need for Data Modernization — Maryland, 2021. *Molly A. Kreuze*
- 12:35 Delayed Diagnosis of a Case of Pneumonic Plague During a Respiratory Disease Pandemic — Wyoming, 2021. *Allison W. Siu*
- 11:30–12:55 CONCURRENT SESSION G2: Vaccine-Preventable and Respiratory Diseases**
Introduction: Stephanie Bialek
Moderator: Julia Gargano
- 11:35 Public Health Actions to Address Measles in Recently Evacuated Afghans Through Operation Allies Welcome, — September–October 2021. *Nina B. Masters*
- 11:55 Geographic Variation of Invasive Pneumococcal Disease Serotypes in U.S. Adults ≥19 Years Following Introduction of 13-Valent Pneumococcal Conjugate Vaccine. *Heidi L. Moline*
- 12:15 Prescribing of Outpatient Antibiotics Commonly Used for Respiratory Infections Among Adults Before and During the COVID-19 Pandemic in Brazil. *Dipesh Solanky*
- 12:35 Genome-based Prediction of Cross-Protective, T Cell-Inducing Targets as Novel Vaccine Antigens for Multiple *Bordetella* Species. *Muktha S. Natrajan*
- 11:30–12:55 CONCURRENT SESSION G3: HIV and STDs**
Introduction: Demetre Daskalakis
Moderator: Xia Michelle Lin
- 11:35 Demographic and Clinical Factors Associated with a Decrease in HIV Diagnoses During the SARS-CoV-2 Pandemic — Georgia, 2020. *Jenna R. Gettings*
- 11:55 Racial/Ethnic Differences in Psychosocial and Structural Factors and HIV Risk Among Transgender Women — Seven Urban Areas, 2019–2020. *Rebecca B. Hershow*
- 12:15 Extragenital Chlamydia and Gonorrhea Testing Among Sexually Active Men Who Have Sex with Men — United States, 2017–2020. *Yasmin P. Ogale*
- 12:35 Prevention and Care Opportunities for People Who Inject Drugs in an HIV Outbreak — Kanawha County, West Virginia, 2019–2021. *Robert A. Bonacci*
- 12:55 BREAK**
- 1:25–2:45** 🏆 **SESSION H: Alexander D. Langmuir Lecture**
Moderators: Rochelle Walensky and Patricia Simone
- 2:45 BREAK**
- 3:15–4:40 CONCURRENT SESSION I1: Infections in Healthcare Settings**
Introduction: Denise Cardo
Moderator: Amy Schumacher
- 3:20 Cluster of Invasive Mucormycosis at an Acute Care Hospital — Arkansas, 2019–2021. *Karen Wu*
- 3:40 COVID-19 Outbreak Among Residents at a Skilled Nursing Facility — Chicago, Illinois, April 2021–June 2021. *Richard A. Teran*
- 4:00 Severity and Transmissibility of Tuberculosis Disease Among Recipients of Bone Allograft Containing Tuberculosis — United States, 2021. *Thomas D. Filardo*
- 4:20 Extrapulmonary Transmission of *Mycobacterium tuberculosis* to Health Care Personnel Exposed to Bone Graft Recipients — Indiana, 2021. *Molly Deutsch-Feldman*

🏆 Awards presented during session.

3:15–4:40 **CONCURRENT SESSION I2: Recreational Risks**

Introduction: Jay Butler

Moderator: Jennifer Cope

- 3:20 Multijurisdictional *Giardia* Outbreak Associated with an Outdoor Film Site — Ventura County, 2021. *Auguste A. Brihn*
- 3:40 SARS-CoV-2 Transmission Associated with an Indoor Music Club Event that Required Proof of Full Vaccination Against COVID-19 Prior to Entry — King County, WA, July 2021. *Mellisa Roskosky*
- 4:00 Splash Pad Associated Fatal *Naegleria fowleri* Infection in a 3-year-old Child — Texas, 2021. *Denisse Vega Ocasio*
- 4:20 SARS-CoV-2 Transmission Among Unvaccinated, Partially Vaccinated, and Vaccinated Crew and Passengers Aboard a 9-day Charter Fishing Cruise — San Diego, CA, August 2021. *Elizabeth Ohlsen*

3:15–4:40 **CONCURRENT SESSION I3: Chronic Disease and Emergency Preparedness**

Introduction: Karen Hacker

Moderator: Dianna Carroll

- 3:20 Knowledge of FDA-Approved Smoking Cessation Medications by Healthcare Providers — DocStyles, 2020. *Thomas M. Golden*
- 3:40 Perspectives on Counseling Women of Reproductive Age About Emergency Preparedness by Primary Healthcare Providers — DocStyles, United States, 2021. *Jessica R. Meeker*
- 4:00 County-Level Associations of Structural and Social Determinants of Health with Gestational Diabetes Prevalence — United States, 2019. *Michele L.F. Bolduc*
- 4:20 Trends in Lipid-Lowering Prescriptions by Statin Intensity — United States, 2015–2021. *Ahlia Sekkarie*

Thursday, May 5, 2022

11:30–12:55 **CONCURRENT SESSION J1: Foodborne and Enteric Outbreaks**

Introduction: Robert Tauxe

Moderator: Jennifer Wright

- 11:35 Multipathogen Foodborne Outbreak Among Hospital Staff — Homer, Alaska, 2021. *Katherine G. Newell*
- 11:55 Multistate Outbreak of *Salmonella* Oranienburg Infections Linked to Onions — United States, 2021. *Christan H. Stager*
- 12:15 Shiga Toxin-Producing *Escherichia coli* Infection Outbreak Among Fair Attendees — Georgia, 2021. *Jenna R. Gettings*
- 12:35 *Salmonella* Mbandaka Outbreak on a College Campus — Maine, 2021. *Parag Mahale*

11:30–12:55 **CONCURRENT SESSION J2: Notes from the Field**

Introduction: Ryan Westergaard

Moderator: Stacey Bosch

- 11:35 SARS-CoV-2 Infections and COVID-19 Vaccine Coverage Among People Living with HIV — Chicago, Illinois, March 2020–December 2021. *Richard A. Teran*
- 11:55 COVID-19 Outbreak Surveillance — Vermont: March 25, 2020–September 23, 2021. *Brian F. Borah*
- 12:15 Regional Cluster of Legionella: Look to the Laboratory — South Carolina, 2021. *Marco Tori*
- 12:25 Contamination of Surfaces Among SARS-CoV-2-Infected Households — San Diego County, California and Metropolitan Denver, Colorado — January–April 2021. *Caroline Q. Pratt*

11:30–12:55 **CONCURRENT SESSION J3: Tuberculosis**

Introduction: Deron Burton

Moderator: Laura Cooley

- 11:35 Tuberculosis Among Native Hawaiian and Pacific Islander Persons — United States and U.S.-Affiliated Pacific Islands, 2010–2019. *Molly Deutsch-Feldman*
- 11:55 Unusual Tuberculosis Cluster with High Attack Rates After Spinal Surgery with a Contaminated Tissue Product — Delaware, 2021. *W. Wyatt Wilson*
- 12:15 Unusual Healthcare Personnel Exposures to *Mycobacterium tuberculosis* Related to a Contaminated Surgical Product — United States, 2021. *Ruoran Li*
- 12:35 Effects of Racial/Ethnic Disaggregation on the Characterization of Tuberculosis Epidemiology Among American Indian and Alaska Native Persons. *Thomas D. Filardo*

12:55 **BREAK**

1:25–2:50 **CONCURRENT SESSION K1: Global Pandemic Response and Impacts**

Introduction: Emily Kainne Dokubo

Moderator: Amy Schumacher

- 1:30 Impact of the COVID-19 Pandemic on Global Routine Vaccination Coverage in 2020. *Pierre Muhoza*
- 1:50 Disruptions to Essential Health Services in Kenya and Cameroon During the COVID-19 Pandemic — February 2020–October 2021. *Matthew J. Hudson*
- 2:10 Using Nigeria’s COVID-19 Vaccination Data to Identify Vaccine Rollout Challenges. *Talya Shragai*
- 2:30 Assessment of the Adverse Events Following Immunization (AEFI) Surveillance and Response System in Liberia. *Katrin S. Sadigh*

1:25–2:50 **CONCURRENT SESSION K2: Vector-Borne Diseases**

Introduction: Lyle Petersen

Moderator: Suzanne Beavers

- 1:30 Increase in Colorado Tick Fever Cases — Montana, 2020. *Raymond A. Soto*
- 1:50 Trap Comparison for Mosquito Vector Surveillance for Eastern Equine Encephalitis Virus — New Jersey, 2021. *Anna C. Fagre*
- 2:10 Clinical Features of COVID-19, Dengue, and Influenza Among Adults Presenting to Emergency Departments and Urgent Care Clinics — Puerto Rico, 2012–2021. *Joshua M. Wong*
- 2:30 Tick-Borne Relapsing Fever Surveillance Practices — Western United States, 2021. *Amy M. Beeson*

1:25–2:50 **CONCURRENT SESSION K3: Waterborne Diseases**

Introduction: Michael Beach

Moderator: Michael Cherry

- 1:30 *Mycobacterium abscessus* in the Cerebrospinal Fluid of Two Hospitalized Patients — Maryland, 2021. *Molly A. Kreuze*
- 1:50 Non-*pneumophila* *Legionella* at an Adult Basketball Camp — North Carolina, 2021. *Erin K. Ricketts*
- 2:10 *Acanthamoeba* Infections: More Than Meets the Eye — United States, 1955–2020. *Julia C. Haston*
- 2:30 Risky Business: Perceptions and Misuse of Tap Water for Home Medical Purposes — PN View 360+ Survey — United States, August 2021. *Shanna Miko*

2:50 **BREAK**

3:20–4:25

SESSION L: Late-Breaking Reports

Presenters: Debra Houry and Eric Pevzner

- 3:25 Transmission of Yellow Fever Vaccine Virus Through Blood Transfusion and Solid Organ Transplantation — United States, 2021. *Raymond A. Soto*
- 3:35 Provider Access to and Coverage of Pediatric COVID-19 Vaccine for Children ages 5–11 years — United States, November 2021–January 2022. *Christine Y. Kim*
- 3:45 Lessons from the Field: A More Granular Assessment of Gender, Race, Ethnicity, and Language — Louisiana, 2021. *Kristin J. Marks*
- 3:55 Outbreak of SARS-CoV-2 Omicron Variant at a Wisconsin Wedding, November 2021. *Hannah E. Segaloff*
- 4:05 Acute Health Impacts Associated with Petroleum Contamination of the Joint Base Pearl Harbor-Hickam Water System — Oahu, Hawaii, November 2021. *Amanda Smith*
- 4:15 Donor-Derived *Strongyloides stercoralis* Infection in Two of Three Organ Transplant Recipients — California, Michigan, Ohio, 2022. *AdeSubomi O. Adeyemo*

4:25–4:35

 **PRESENTATION OF AWARDS**

Presenter: Danice Eaton

- Anne Schuchat Distinguished Friend of EIS Award
- Donald C. Mackel Memorial Award
- J. Virgil Peavy Memorial Award
- Paul C. Schnitker International Health Award
- Iain C. Hardy Award
- James H. Steele Veterinary Public Health Award
- Mitch Singal Excellence in Occupational and Environmental Health Award
- Shalon M. Irving Health Equity Award

4:35–4:45

CLOSING REMARKS

Presenter: Patricia Simone

POST-CONFERENCE ACTIVITY

7:30

 **POST-CONFERENCE EIS SATIRICAL REVIEW**
Presentation of Philip S. Brachman Award

 *Awards presented during session.*

Awards Descriptions and Committee Members

Alexander D. Langmuir Prize Manuscript Award

The Alexander D. Langmuir Prize, established in 1966 by the EIS Alumni Association and sponsored by Joanna Buffington, EIS '90 in partnership with the CDC Foundation, encourages EIS officers to publish papers based on epidemiologic work done while in the EIS. This prize recognizes a current EIS officer or recent alumnus (1 year) for excellence in a written report or an epidemiologic investigation or study.

2022 Committee Members: Gus Birkhead (Chair), Hammad Ali, Linda Bartlett, Isaac Benowitz, Kathy Gensheimer, Lisa Oakley, Lindsey Shields, Evelyn Twentyman

Philip S. Brachman Award

The Philip S. Brachman Award, sponsored by the graduating class of EIS officers and the EIS Alumni Association, recognizes excellence in teaching epidemiology to EIS officers.

2022 Committee Members: Class of 2020

Anne Schuchat Distinguished Friend of EIS Award

The Anne Schuchat Distinguished Friend of EIS Award, sponsored by the EIS Alumni Association, recognizes an individual for valued contributions that have made an important difference to the health, welfare, and happiness of EIS officers and the EIS Program.

2022: EIS Program Leadership

Iain C. Hardy Award

The Iain C. Hardy Award, sponsored by the National Center for Immunization and Respiratory Diseases in partnership with the CDC Foundation, recognizes a current EIS officer or alumnus (within 5 years) who has made an outstanding contribution to the control of vaccine preventable diseases.

2022 Committee Members: Samuel Posner (Chair), Melinda Wharton, (Co-Chair), Stephanie Schrag, David Fitter, John Modlin, William Schaffner

J. Virgil Peavy Memorial Award

The J. Virgil Peavy Memorial Award, established in 2003 and sponsored by the EIS Alumni Association, recognizes a current EIS officer for the oral presentation that best exemplifies the effective and innovative application of statistics and epidemiologic methods in an investigation or study.

2022 Committee Members: Brooke Hoots (Chair), Josip Derado, Xia Michelle Lin, Duong (Tony) Nguyen, Yang Liu

Donald C. Mackel Memorial Award

The Donald C. Mackel Memorial Award, created by the EIS Alumni Association in partnership with the CDC Foundation, recognizes a current EIS officer for the oral presentation that best exemplifies the effective application of a combined epidemiology and laboratory approach to an investigation or study.

2022 Committee Members: Kevin Clarke (Chair), Julia Gargano, Michelle Hughes, John Kools, Michele Owen

Outstanding Poster Presentation Award

The Outstanding Poster Presentation Award is sponsored by the EIS Alumni Association and presented by the EIS Scientific Program Committee to a current EIS officer for the poster that best exemplifies scientific content, including originality, study design and analysis; public health impact; and presentation effectiveness.

2022 Committee Members: No poster presentations for 2022 conference

Paul C. Schnitker International Health Award

Paul C. Schnitker, MD, passed away in a plane crash in Nigeria in 1969. He was en route to serve as a public health officer in the response to a famine and other public health problems resulting from the Biafra Civil War in Nigeria. He is the only person who has died while serving as an EIS officer. The Paul C. Schnitker International Health Award, sponsored by the Schnitker family in partnership with the CDC Foundation, recognizes a current EIS officer who has made a significant contribution to international public health.

2022 Committee Members: Kevin Clarke (Chair),
Joel Montgomery, Florina Serbanescu, Almea Matanock,
Michael Jhung

James H. Steele Veterinary Public Health Award

The James H. Steele Veterinary Public Health Award, sponsored by CDC veterinarians in partnership with the CDC Foundation, recognizes a current EIS officer or alumnus (within 5 years) who has made outstanding contributions in the field of veterinary public health through outstanding contributions in the investigation, control, or prevention of zoonotic diseases or other animal-related human health problems.

2022 Committee Members: Ryan Wallace (Chair), Casey Barton Behravesh (Co-Chair), Colin Basler, Caitlin Cossaboom, Kirk Smith, Radhika Gharpure

Mitch Singal Excellence in Occupational and Environmental Health Award

The Mitch Singal Excellence in Occupational and Environmental Health Award, co-sponsored by the National Institute for Occupational Safety and Health and the National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, was established in 2010. The Mitch Singal Award recognizes a current EIS officer for excellence in an oral presentation that best exemplifies the effective application of public health epidemiology to an investigation in the area of occupational or environmental health.

2022 Committee Members: Maria Mirabelli (Chair),
Ethan Fechter-Leggett (Co-Chair), Suzanne Beavers,
Kevin Chatham-Stephens, Jonathan Meiman, Jacek Mazurek,
Audrey Pennington, Kanta Sircar, Suzanne Tomasi

Stephen B. Thacker Excellence in Mentoring Award

The Stephen B. Thacker Excellence in Mentoring Award, established in 2013 by the EIS Alumni Association and sponsored by the Thacker family in partnership with the CDC Foundation, recognizes an individual who is an inspiration to the EIS community and exhibits unwavering commitment to the EIS Program, officers, and alumni through demonstrated excellence in applied epidemiology training, mentoring, and building public health capacity.

2022 Committee Members: Gus Birkhead (Chair),
Hammad Ali, Larry Cohen (EIS Program rep, non-voting),
Fatima Coronado, Maria Thacker Goethe, Pamela Mahoney

Shalon M. Irving Health Equity Award

The Shalon M. Irving Health Equity Award, established by the EIS Program and sponsored by the EIS Alumni Association, was awarded for the first time in 2018. The Shalon M. Irving Award recognizes a current EIS officer or recent alumni (classes 2015–2018) for having made exemplary contributions in the areas of health equity and racial disparities research.

2022 Committee Members: NaTasha Hollis (Chair)
and Asha Ivey-Stephenson (Co-Chair), Erika Odom,
Francisca Abanyie-Bimbo, Jennifer Lind, Rachel Idowu,
Rashid Njai, Janet Blair, Michelle Chevalier

David J. Sencer Scholarship Award

The David J. Sencer Scholarship Award fund was established by the EIS Alumni Association to provide travel scholarships to potential Epidemic Intelligence Service (EIS) applicants to attend the EIS Conference each year. For a list of scholarship recipients, contact EISAA.

2022 Committee Members: Linda Bartlett (Chair),
Gus Birkhead, Kathleen Gensheimer, Greg Heath,
Beth Rubenstein, Kristina Zierold

EIS Awards 2021 Presentation Series

Alexander D. Langmuir Prize Manuscript Award
Melissa Arons

Philip S. Brachman Award
Jennifer Liang (EIS 2005)

Anne Schuchat Distinguished Friend of the EIS Award
Anne Schuchat

Iain C. Hardy Award
Heidi Soeters (EIS 2014)

J. Virgil Peavy Memorial Award
Not awarded for 2021

Donald C. Mackel Memorial Award
Not awarded for 2021

Outstanding Poster Presentation Award
Not awarded for 2021

Paul C. Schnitker International Health Award

Rachael Zacks (EIS 2019)

James H. Steele Veterinary Public Health Award

Jesse Bonwitt (EIS 2016)

Mitch Singal Excellence in Occupational and Environmental Health Award

Not awarded for 2021

Stephen B. Thacker Excellence in Mentoring Award

John Kobayashi (EIS 1979)

Shalon M. Irving Health Equity Award

Miriam Van Dyke (EIS 2020)

Alexander D. Langmuir Lectures, 1972–2021

The Langmuir Lecture is the preeminent public health lecture in the United States. The first lecture was given in 1972, and it has been a highlight of the annual EIS Conference each year since then. The lecture is named for Alexander D. Langmuir, MD, MPH (1910–1993), a public health visionary and leader who established the Epidemiology Program at what was then called the Communicable Disease Center in 1949; he remained as CDC's chief epidemiologist until his retirement in 1970.

Notably, Dr. Langmuir founded EIS, established national disease surveillance for the United States, and brought the *Morbidity and Mortality Weekly Report* to CDC. Langmuir Lecture speakers have included Abraham Lilienfeld, Sir Richard Doll, Geoffrey Rose, Jonas Salk, and many other prominent public health thinkers and researchers.

- 1972 Prevention of Rheumatic Heart Disease — Fact or Fancy.
Charles H. Rammelkamp
- 1973 Cytomegaloviral Disease in Man: An Ever Developing Problem.
Thomas H. Weller
- 1974 Hepatitis B Revisited (By the Non-Parenteral Route).
Robert W. McCollum
- 1975 Origin, Spread, and Disappearance of Kuru: Implications of the Epidemic Behavior of a Disease in New Guineans for the Epidemiologic Study of Transmissible Virus Dementias.
D. Carleton Gajdusek
- 1976 The Future of Epidemiology in the Hospital.
Paul F. Wehrle

- 1977 The Historical Evolution of Epidemiology.
Abraham Lilienfeld
- 1978 The Biology of Cancer: An Epidemiological Perspective.
Sir Richard Doll
- 1979 The Epidemiology of Antibiotic Resistance.
Theodore C. Eickoff
- 1980 Health and Population Growth.
Thomas McKeown
- 1981 The Pathogenesis of Dengue: Molecular Epidemiology in Infectious Disease.
Scott B. Halstead
- 1982 The Epidemiology of Coronary Heart Disease: Public Health Implications.
Henry W. Blackburn, Jr.
- 1983 Sexually Transmitted Diseases — Past, Present, and Future.
King K. Holmes
- 1984 Poliomyelitis Immunization — Past and Future.
Jonas E. Salk
- 1985 An Epidemiologist's View of Postmenopausal Estrogen Use, or What to Tell Your Mother.
Elizabeth Barrett-Connor
- 1986 Hepatitis B Virus and Hepatocellular Carcinoma: Epidemiologic Considerations.
Robert Palmer Beasley
- 1987 Environmental Hazards and the Public Health.
Geoffrey Rose
- 1988 Lymphotropic Retroviruses in Immunosuppression.
Myron E. (Max) Essex
- 1989 Aspirin in the Secondary and Primary Prevention of Cardiovascular Disease.
Charles H. Hennekens
- 1990 Epidemiology and Global Health.
William H. Foege
- 1991 Public Health Action in a New Domain: The Epidemiology and Prevention of Violence.
Garen J. Wintemute
- 1992 *Helicobacter pylori*, Gastritis, Peptic Ulcer Disease, and Gastric Cancer.
Martin J. Blasér
- 1993 Diet and Health: How Firm Is Our Footing?
Walter C. Willett
- 1994 Alexander D. Langmuir: A Tribute to the Man.
Philip S. Brachman and William H. Foege

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- 1995 Epidemiology and the Elucidation of Lyme Disease.
Allen C. Steere
- 1996 50 Years of Epidemiology at CDC.
Jeffrey P. Koplan
- 1997 Public Health, Population-Based Medicine, and Managed Care.
Diana B. Petitti
- 1998 Pandemic Influenza: Again?
Robert Couch
- 1999 The Evolution of Chemical Epidemiology.
Philip J. Landrigan
- 2000 Does *Chlamydia pneumoniae* Cause Atherosclerotic Cardiovascular Disease? Evaluating the Role of Infectious Agents in Chronic Diseases.
Walter E. Stamm
- 2001 Halfway Through a Century of Excellence.
J. Donald Millar
- 2002 Public Health Response to Terrorism: Rising to the Challenge.
Marcelle Layton
- 2003 Alex Langmuir's Somewhat Quiet Legacy: Epidemiology, Sexual Health, and Personal Choices.
Willard (Ward) Cates, Jr.
- 2004 HIV, Epidemiology, and the CDC.
James W. Curran
- 2005 Killin' Time: Alcohol and Injury.
Alexander C. Wagenaar
- 2006 Measuring Malaria.
Brian Greenwood
- 2007 Implications of Tuberculosis Control on Evidence-Based Public Health Practice.
Thomas R. Frieden
- 2008 Physical Activity and Public Health: Does the Environment Matter?
Ross C. Brownson
- 2009 Epidemiology, Public Health, and Public Policy.
Jim Marks
- 2010 Community Health Rankings — Epidemiology in Action.
Pat Remington
- 2011 Skirmishes, Battles, and Wars: Tracking Infection Control Success in the Age of Social Networks.
Robert A. Weinstein
- 2012 Prevention of Teen Pregnancy: What Do We Know? Where Do We Go?
Robert Blum
- 2013 The Role of EIS in Communities of Solution: Using GIS and Epidemiology to Activate Health Partnerships.
Robert Phillips
- 2014 EIS in an Era of Data, Technology, and Urban Transformations.
Martin-J. Sepulveda
- 2015 Large-Scale Machine Learning and Its Application to Public Health.
Jeff Dean
- 2016 From Antibiotic Resistance to Zika: Reflections on Working at the Intersection of Science and Public Health Politics.
Margaret Hamburg
- 2017 Moving from Epidemiology to Quantitative Population Health Science.
Sandro Galea
- 2018 Better Health through Better Partnerships.
Vice Admiral Jerome M. Adams
- 2019 Understanding of history as crucial to moving forward.
Dr. Hanna-Attisha
- 2020 No Lecture in 2020.
- 2021 History and function of the EIS program.
Former CDC Director William H. Foege, MD, MPH
- Alexander D. Langmuir Prize Manuscripts, 1966–2021**
- 1966 Complications of Smallpox Vaccination: I. National Survey in the United States, 1963. *N Engl J Med* 1967;276:125–32.
J.M. Neff, J.M. Lane, J.H. Pert, R. Moore, J.D. Millar, D.A. Henderson
- 1967 An Outbreak of Neuromyasthenia in a Kentucky Factory — The Possible Role of a Brief Exposure to Organic Mercury. *Am J Epidemiol* 1967;86:756–64.
G. Miller, R. Chamberlin, W.M. McCormack
- 1968 Salmonellosis from Chicken Prepared in Commercial Rotisseries: Report of an Outbreak. *Am J Epidemiol* 1969;90:429–37.
S.B. Werner, J. Allard, E.A. Ager

- 1969 Outbreak of Tick-Borne Relapsing Fever in Spokane County, Washington. *JAMA* 1969;210:1045–50.
R.S. Thompson, W. Burgdorfer, R. Russell, B.J. Francis
- 1970 Tularemia Epidemic: Vermont, 1968 — Forty-Seven Cases Linked to Contact with Muskrats. *N Engl J Med* 1969;280:1253–60.
L.S. Young, D.S. Bicknell, B.G. Archer, et al.
- 1971 Tomato Juice-Associated Gastroenteritis, Washington and Oregon, 1969. *Am J Epidemiol* 1972;96:219–26.
W.H. Barker Jr., V. Runte
- 1972 *Salmonella* Septicemia from Platelet Transfusions: Study of an Outbreak Traced to a Hematogenous Carrier of *Salmonella cholerae-suis*. *Ann Intern Med* 1973;78:633–41.
F.S. Rhame, R.K. Root, J.D. MacLowry, T.A. Dadisman, J.V. Bennett
- 1973 Outbreak of Typhoid Fever in Trinidad in 1971 Traced to a Commercial Ice Cream Product. *Am J Epidemiol* 1974;100:150–7.
A. Taylor Jr., A. Santiago, A. Gonzales-Cortes, E.J. Gangarosa
- 1974 Oyster-Associated Hepatitis: Failure of Shellfish Certification Programs To Prevent Outbreaks. *JAMA* 1975;233:1065–8.
B.L. Portnoy, P.A. Mackowiak, C.T. Caraway, J.A. Walker, T.W. McKinley, C.A. Klein Jr.
- 1975 Staphylococcal Food Poisoning Aboard a Commercial Aircraft. *Lancet* 1975;2:595–9.
M.S. Eisenberg, K. Gaarslev, W. Brown, M. Horwitz, D. Hill
- 1976 Nursery Outbreak of Peritonitis with Pneumoperitoneum Probably Caused by Thermometer-Induced Rectal Perforation. *Am J Epidemiol* 1976;104:632–44.
M.A. Horwitz, J.V. Bennett
- 1977 Epidemic *Yersinia enterocolitica* Infection due to Contaminated Chocolate Milk. *N Engl J Med* 1978;298:76–9.
R.E. Black, R.J. Jackson, T. Tsai, et al.
- 1978 Measles Vaccine Efficacy in Children Previously Vaccinated at 12 Months of Age. *Pediatrics* 1978;62:955–60.
J.S. Marks, T.J. Halpin, W.A. Orenstein
- 1979 An Outbreak of Legionnaires' Disease Associated with a Contaminated Air-Conditioning Cooling Tower. *N Engl J Med* 1980;302:365–70.
T.J. Dondero Jr., R.C. Rendtorff, G.F. Mallison, et al.
and
Risk of Vascular Disease in Women: Smoking, Oral Contraceptives, Noncontraceptive Estrogens, and Other Factors. *JAMA* 1979;242:1150–4.
D.B. Petitti, J. Wingerd, J. Pellegrin, et al.
- 1980 Injuries from the Wichita Falls Tornado: Implications for Prevention. *Science* 1980;207:734–8.
R.I. Glass, R.B. Craven, D.J. Bregman, et al.
- 1981 Respiratory Irritation due to Carpet Shampoo: Two Outbreaks. *Environ Int* 1982;8:337–41.
K. Kreiss, M.G. Gonzalez, K.L. Conright, A.R. Scheere
and
Toxic-Shock Syndrome in Menstruating Women: Association with Tampon Use and *Staphylococcus aureus* and Clinical Features in 52 Cases. *N Engl J Med* 1980;303:1436–42.
K.N. Shands, G.P. Schmid, B.B. Dan, et al.
- 1982 Risk Factors for Heatstroke: A Case-Control Study. *JAMA* 1982;247:3332–6.
E.M. Kilbourne, K. Choi, T.S. Jones, S.B. Thacker
- 1983 Epidemic Listeriosis C — Evidence for Transmission by Food. *N Engl J Med* 1983;308:203–6.
W.F. Schlech III, P.M. Lavigne, R.A. Bortolussi, et al.
- 1984 Unexplained Deaths in a Children's Hospital: An Epidemiologic Assessment. *N Engl J Med* 1985;313:211–6.
J.W. Buehler, L.F. Smith, E.M. Wallace, C.W. Heath, R. Kusiak, J.L. Herndon
and
Medication Errors with Inhalant Epinephrine Mimicking an Epidemic of Neonatal Sepsis. *N Engl J Med* 1984;310:166–70.
S.L. Solomon, E.M. Wallace, E.L. Ford-Jones, et al.
- 1985 The Use and Efficacy of Child-Restraint Devices: The Tennessee Experience, 1982 and 1983. *JAMA* 1984;252:2571–5.
M.D. Decker, M.J. Dewey, R.H. Hutcheson Jr., W.S. Schaffner
- 1986 The Role of Parvovirus B19 in Aplastic Crisis and Erythema Infectiosum (Fifth Disease). *J Infect Dis* 1986;154:383–93.
T.L. Chorba, P. Coccia, R.C. Holman, et al.

- 1987 Oral Contraceptives and Cervical Cancer Risk in Costa Rica: Detection Bias or Causal Association? *JAMA* 1988;259:59–64.
K.L. Irwin, L. Rosero-Bixby, M.W. Oberle, et al.
- 1988 A Day-Care–Based Case-Control Efficacy Study of *Haemophilus influenzae* B Polysaccharide Vaccine. *JAMA* 1988;260:1413–8.
L.H. Harrison, C. Broome, A.W. Hightower, et al.
- 1989 Group A Meningococcal Carriage in Travelers Returning from Saudi Arabia. *JAMA* 1988;260:2686–9.
P.S. Moore, L.H. Harrison, E.E. Telzak, G.W. Ajello, C.V. Broome
and
Transmission of *Plasmodium vivax* Malaria in San Diego County, California, 1986. *Am J Trop Med Hyg* 1990;42:3–9.
Y.A. Maldonado, B.L. Nahlen, R.R. Roberta, et al.
- 1990 An Outbreak of Surgical Wound Infections due to Group A Streptococcus Carried on the Scalp. *N Engl J Med* 1990;323:968–72.
T.D. Mastro, T.A. Farley, J.A. Elliott, et al.
- 1991 An Investigation of the Cause of the Eosinophilia-Myalgia Syndrome Associated with Tryptophan Use. *N Engl J Med* 1990;323:357–65.
E.A. Belongia, C.W. Hedberg, G.J. Gleich, et al.
- 1992 An Outbreak of Multidrug-Resistant Tuberculosis Among Hospitalized Patients with the Acquired Immunodeficiency Syndrome. *N Engl J Med* 1992;326:1514–21.
B.R. Edlin, J.I. Tokars, M.H. Grieco, et al.
- 1993 Comparison of Prevention Strategies for Neonatal Group B Streptococcal Infection: A Population-Based Economic Analysis. *JAMA* 1993;270:1442–8.
J.C. Mohle-Boetani, A. Schuchat, B.D. Plikaytis, J.D. Smith, C.V. Broome
and
Retrospective Study of the Impact of Lead-Based Hazard Remediation on Children's Blood Lead Levels in St. Louis, Missouri. *Am J Epidemiol* 1994;139:1016–26.
C. Staes, T. Matte, C.B. Copley, D. Flanders, S. Binder
- 1994 A Massive Outbreak in Milwaukee of *Cryptosporidium* Infection Transmitted Through the Public Water Supply. *N Engl J Med* 1994;331:161–7.
W.R. Mac Kenzie, N.J. Hoxie, M.E. Proctor, et al.
- 1995 A Multistate Outbreak of *Escherichia coli* 0157:H7-Associated Bloody Diarrhea and Hemolytic Uremic Syndrome from Hamburgers: The Washington Experience. *JAMA* 1994;272:1349–53.
B.P. Bell, M. Goldoft, P.M. Griffin, et al.
- 1996 A Multistate Outbreak of *Salmonella* Enteritidis Infections Associated with Consumption of Schwan's Ice Cream. *N Engl J Med* 1996;334:1281–6.
T.W. Hennessy, C.W. Hedberg, L. Slutsker, et al.
and
Passenger to Passenger Transmission of *Mycobacterium tuberculosis* Aboard Commercial Aircraft During Transoceanic Travel. *N Engl J Med* 1996;334:993–8.
T.A. Kenyon, S.E. Valway, W.W. Ihle, I.M. Onorato
- 1997 Epidemic Meningococcal Disease and Tobacco Smoke: A Risk Factor Study in the Pacific Northwest. *Pediatr Infect Dis J* 1997;16:979–83.
M.A. Fisher, K. Hedberg, P. Cardosi, et al.
- 1998 Suicide After Natural Disasters. *N Engl J Med* 1998;338:373–8.
E.G. Krug, M. Kresnow, J.P. Peddicord, et al.
- 1999 Legalized Physician-Assisted Suicide in Oregon — The First Year's Experience. *N Engl J Med* 1999;340:577–83.
A.E. Chin, K. Hedberg, G.K. Higginson, D.W. Fleming
- 2000 Infantile Hypertrophic Pyloric Stenosis After Pertussis Prophylaxis with Erythromycin: A Case Review and Cohort Study. *Lancet* 1999;354:2101–5.
M.A. Honein, L.J. Paulozzi, I.M. Himmelright, et al.
- 2001 *Salmonella* Typhimurium Infections Transmitted by Chlorine-Pretreated Clover Sprout Seeds. *Am J Epidemiol* 2001;154:1020–8.
J.T. Brooks, S. Rowe, P. Shillam, et al.
- 2002 *Serratia liquefaciens* Bloodstream Infections from Contamination of Epoetin Alfa at a Hemodialysis Center. *N Engl J Med* 2001;344:1491–7.
L.A. Grohskopf, V.R. Roth, D.R. Feikin, et al.
- 2003 Transmission of West Nile Virus from an Organ Donor to Four Transplant Recipients. *N Engl J Med* 2003;348:2196–203.
M. Iwamoto, D.B. Jernigan, A. Guasch, et al., the West Nile Virus in Transplant Recipients Investigation Team
- 2004 Risk of Bacterial Meningitis in Children with Cochlear Implants. *N Engl J Med* 2003;349:435–45.
J. Reefhuis, M.A. Honein, C.G. Whitney, et al.
- 2005 Changes in Invasive Pneumococcal Disease Among HIV-Infected Adults Living in the Era of Childhood Pneumococcal Immunization. *Ann Intern Med* 2006;144:1–9.
B.L. Flannery, R.T. Heffernan, L.H. Harrison, et al.

- 2006 Case-Control Study of an Acute Aflatoxicosis Outbreak, Kenya, 2004. *Environ Health Perspect* 2005;113:1779–83.
E. Azziz-Baumgartner, K.Y. Lindblade, K. Gieseke, et al., and the Aflatoxin Investigative Group
- 2007 Methamphetamine Use Is Independently Associated with Risky Sexual Behaviors and Adolescent Pregnancy. *J Sch Health* 2008;78:641–8.
L.B. Zapata, S.D Hillis, P.M. Marchbanks, K.M. Curtis, R. Lowry
- 2008 Characteristics of Perpetrators in Homicide-Followed-by-Suicide Incidents: National Violent Death Reporting System — 17 U.S. States, 2003–2005. *Am J Epidemiol* 2008;168:1056–64.
J. Logan, H.A. Hill, A.E. Crosby, D.L. Karch, J.D. Barnes, K.M. Lubell
- 2009 Epidemiologic Investigation of Immune-Mediated Polyradiculoneuropathy Among Abattoir Workers Exposed to Porcine Brain. *PLoS ONE*. 2009;5:e9782.
S.M. Holzbauer, A.S. DeVries, J.J. Sejvar, et al.
- 2010 Increasing Compliance with Mass Drug Administration Programs for Lymphatic Filariasis in Orissa, India, 2009 — Impact of an Education and a Lymphedema Management Program. *PLoS Negl Trop Dis* 2010;201;4:e728.
P.T. Cantey, J. Rout, G. Rao, J. Williamson, L.M. Fox
- 2011 Effect of Rotavirus Vaccine on Healthcare Utilization for Diarrhea in U.S. Children. *N Engl J Med* 2011;365;12:1108–17.
J. Cortes, A. Curns, J. Tate, M. Cortese, M. Patel, F. Zhou, U. Parashar
- 2012 Multistate Outbreak of *Escherichia coli* O157:H7 Infections Associated with In-Store Sampling of a Raw-Milk Gouda Cheese, 2010. *J. Food Prot.* 2012 Oct;75(10):1759–65.
J. McCollum, N. Williams, S. W. Beam, et al.
- 2013 Necrotizing Cutaneous Mucormycosis after a Tornado in Joplin, Missouri, in 2011. *N Engl J Med* 2012;367;22:14–25.
R. Fanfair, K. Benedict, J. Bos, et al.
- 2014 Raccoon Rabies Virus Variant Transmission Through Solid Organ Transplantation. *JAMA* 2013;310:398–407.
N.M. Vora, S.V. Basavaraju, KA Feldman, et al.
- 2015 New Delhi Metallo-Beta-Lactamase-Producing Carbapenem-Resistant *E. coli* Associated with Exposure to Duodenoscopes. *JAMA* 2014;312(14):1447–55.
L. Epstein, J.C. Hunter, M.A. Arwady, et al.
- 2016 Exposure to Advertisements and Electronic Cigarette use Among U.S. Middle and High School Students. *Pediatrics* 2016;137(5):e20154155.
T. Singh, I.T. Agaku, R.A. Arrazola, K.L. Marynak, L.J. Neff, I.T. Rolle, B.A. King
- 2017 Geospatial Analysis of Household Spread of Ebola Virus in a Quarantined Village — Sierra Leone, 2014. *Epidemiol Infect* 2017;145(14):2921–2929.
B.L. Gleason, S. Foster, G.E. Wilt, et al.
- 2018 Educational Disabilities Among Children Born with Neonatal Abstinence Syndrome. *Pediatrics*. 2018 Sep;142(3).
M.A. Fill, A.M. Miller, R.H. Wilkinson
- 2019 Infections Transmitted in the Community — Homelessness and Hepatitis A — San Diego County, 2016–2018. *Clin Infect Dis* 2020;71(1):14–21.
C.M. Peak, S.S. Stpis, J.M. Healy, et al.
- 2020 Factors Associated with *Candida auris* Colonization and Transmission in Skilled Nursing Facilities with Venticular Units, New York, 2016–2018. *Clin Infect Dis* 2021;72(11):e753–e760.
J. Rossow, B. Ostrowsky, E. Adams, et al.
- 2021 Presymptomatic SARS-CoV-2 Infections and Transmission in a Skilled Nursing Facility. *N Engl J Med*. 2020;382(22):2081–2090.
M.M. Arons, K.M. Hatfield, S.C. Reddy, et al.

Philip S. Brachman Awards, 1983–2021

- 1983 Philip Brachman
1984 Michael Gregg
1985 Howard Ory
1986 J. Lyle Conrad
1987 Andrew G. Dean
1988 Richard C. Dicker
1989 Carl W. Tyler, Jr.
1990 Richard C. Dicker
1991 Richard C. Dicker
1992 Jeffrey J. Sacks
1993 J. Lyle Conrad and Michael Toole
1994 Willard (Ward) Cates and Robert Breiman
1995 John Horan
1996 Polly Marchbanks

1997 William Mac Kenzie
1998 Laura A. Coker
1999 Christine Zahniser
2000 Jeffrey J. Sacks
2001 Douglas H. Hamilton
2002 Marcelle Layton, Steve Weirsma, James L. Hadler,
Eddy Bresnitz, Elizabeth Barrett, Robert B. Stroube,
Ross J. Brechner, David S.B. Blythe, Larry Siegel,
Karyn Berry, Sherri Adams, John Eisold, and
Greg Martin
2003 Deborah W. Gould
2004 Jim Alexander
2005 Julie Magri
2006 Ralph Henderson
2007 Joshua Mott and Peter Cegielski
2008 Lisa Pealer
2009 C. Kay Smith and Julie Magri
2010 Betsy Gunnels
2011 William Schaffner
2012 Rachel N. Avchen
2013 Stephen B. Thacker
2014 Douglas H. Hamilton
2015 Julie Magri
2016 Diana Bensyl
2017 Joshua Mott and Michael King
2018 Anne Schuchat
2019 Michael Gronostaj
2020 Eric Pevzner and Tara Henning
2021 Jennifer Liang

Anne Schuchat Distinguished Friend of EIS Awards, 1984–2021

1984 Virgil Peavy
1985 William Schaffner
1986 Mary Moreman
1987 James Chin
1988 Frances H. Porcher
1989 Not Awarded
1990 J. Lyle Conrad
1991 Alexander D. Langmuir
1992 Laurence R. Foster
1993 Kenneth L. Herrmann and William Roper
1994 Louise McFarland
1995 Mike Osterholm
1996 Jim Curran and Larry Schonberger
1997 Patsy Bellamy
1998 John Horan
1999 Not Awarded
2000 James Hadler
2001 Barbara R. Holloway and William R. Jarvis
2002 Patricia Fleming and Stephen B. Thacker
2003 Paul Blake
2004 David Sencer

2005 Not Awarded
2006 Robert Tauxe and Kashef Ijaz
2007 Dixie Snider
2008 Denise Koo
2009 Arjun Srinivasan
2010 Robert Quick
2011 Thomas Peterman
2012 Jeffrey P. Davis
2013 Douglas H. Hamilton
2014 William Keene
2015 David B. Callahan
2016 Sally Brown
2017 Marcelle “Marci” Layton and Mary Anne Duncan
2018 Robert “Mike” Hoekstra
2019 Janell Routh
2020 Jeffrey Engel
2021 Anne Schuchat

Iain C. Hardy Awards, 1996–2021

1996 Peter Strebel
1997 D. Rebecca Prevots
1998 Beth P. Bell
1999 Charles R. Vitek
2000 Linda Quick and Nancy Rosenstein
2001 Orin S. Levine
2002 Umesh D. Parashar
2003 Karen A. Hennessey
2004 Tim Uyeki and Montse Soriano-Gabarro
2005 Julie Jacobson-Bell
2006 Gustavo Dayan
2007 Brendan Flannery
2008 Mona Marin
2009 Amanda Cohn and Rosalyn O’Laughlin
2010 Amy Parker Fiebelkorn
2011 Jacqueline E. Tate
2012 Preeta Kutty
2013 James L. Goodson
2014 Catherine Yen
2015 Minal K. Patel
2016 Eugene Lam
2017 Paul A. Gastañaduy
2018 Robert “Mike” Hoekstra
2019 Jose E. Hagan
2020 No Award
2021 Heidi Soeters

J. Virgil Peavy Memorial Awards, 2003–2021

2003 Danice Eaton
2004 Lori A. Pollack
2005 Andrea Sharma
2006 Andrea Sharma
2007 Abhijeet Anand and David Lowrance

2008 Katherine Ellingson
2009 Michael L. Jackson
2010 Erin Murray
2011 Matthew Willis
2012 Noha H. Farag
2013 Alison Laufer
2014 Matthew Maenner
2015 Jin Qin
2016 Christopher Lee
2017 Julie Lynn Self
2018 Elizabeth Soda
2019 Heather Reese
2020 No Award
2021 No Award

Donald C. Mackel Memorial Awards, 1987–2021

- 1987 Fatal Parathion Poisoning — Sierra Leone.
Ruth A. Etzel
- 1988 Multistate Outbreak of Legionnaires' Disease Involving
Tours to Vermont.
Margaret Mamolen
- 1989 Nosocomial Outbreak of Legionnaires' Disease
Associated with Shower Use: Possible Role of Amoebae.
Robert F. Breiman
- 1990 Legionnaires' Disease Outbreak Associated with a
Grocery Store Mist Machine.
Frank J. Mahoney
- 1991 Nosocomial Outbreak of Isoniazid- and Streptomycin-
Resistant Tuberculosis Among AIDS Patients,
New York City.
Brian R. Edlin
- 1992 Bacillary Angiomatosis, New Infectious Disease:
Epidemiology, Clinical Spectrum, and Diagnostics.
Janet C. Mohle-Boetani
- 1993 Hepatitis B Virus Transmission Associated with
Thoracic Surgery, Los Angeles.
Rafael Harpaz
- 1994 Schistosomiasis and Lake Malawi: A New Site of
Transmission Posing a Serious Risk to Expatriates and
Tourists.
Martin S. Cetron
- 1995 Use of Urinary Antigen Testing To Detect an Outbreak
of Nosocomial Legionnaires' Disease in Connecticut,
1994.
Lisa A. Lepine
- 1996 International Outbreak of *Salmonella* Infections Caused
by Alfalfa Sprouts Grown from Contaminated Seed.
Barbara E. Mahon
and
Malassezia pachydermatis Fungemia in Neonatal
Intensive Care Unit Patients: There's a [New] Fungus
Among Us!
Huan Justina Chang
- 1997 Epidemic of Deaths from Acute Renal Failure Among
Children in Haiti.
Katherine L. O'Brien
- 1998 And Weighing in at 25 Million Pounds — A Multistate
Outbreak of *Escherichia coli* O157:H7 Infections and the
Largest Ground Beef Recall in United States History.
Kate Glynn
- 1999 Clinical Mismanagement of Community Outbreak? The
Contribution of DNA Finger-Printing to the Analysis of
Chronic, Drug-Resistant Tuberculosis in Buenaventura,
Colombia, 1998.
Kayla F. Laserson
- 2000 *Serratia liquefaciens* Bloodstream Infections and
Pyrogenic Reactions Associated with Extrinsically
Contaminated Erythropoietin — Colorado.
Lisa Grohskoph
- 2001 When Beauty Is More Than Skin Deep: An Outbreak
of Rapidly Growing Mycobacterial Furunculosis
Associated with a Nail Salon — California, 2000.
Kevin L. Winthrop
- 2002 Dances with Cows? A Large Outbreak of *E. coli* O157
Infections at Multi-Use Community Facility — Lorain
County, Ohio, September 2001.
Jay K. Varma
- 2003 Hepatitis C Virus Transmission from an Antibody-
Negative Organ and Tissue Donor.
Barna D. Tugwell
- 2004 Multiple Hepatitis A Outbreaks Associated with Green
Onions Among Restaurant Patrons — Tennessee,
Georgia, and North Carolina, 2003.
Joseph J. Amon
- 2005 Case-Control Study of an Acute Aflatoxicosis Outbreak.
E. Azziz-Baumgatner
- 2006 Delayed Onset of *Pseudomonas fluorescens* Group
Bloodstream Infections After Exposure to Contaminated
Heparin Flush — Michigan and South Dakota.
Mark Gershman

- 2007 Epidemiologic and Molecular Investigation of an Outbreak of Hepatitis C Viral Infection at Hemodialysis Unit — Richmond Virginia, 2006.
Nicola Thompson
- 2008 Multistate Measles Outbreak Associated with an International Youth Sporting Event — Pennsylvania, Michigan, and Texas, August–September 2007.
Tai-Ho Chen
- 2009 Cardiac Events and Deaths in a Dialysis Facility Associated with Healthcare Provider — Texas, 2008.
Melissa K. Schaefer
- 2010 Fatal Case of Laboratory-Acquired Infection with an Attenuated *Yersinia pestis* Strain of Plague — Illinois, 2009.
Andrew Medina-Marino
- 2011 Outbreak of Nosocomial Listeriosis — Texas, 2010.
Noha H. Farag
- 2012 Pyrrolizidine Alkaloid Toxicity as the Cause of Unknown Liver Disease — Tigray, Ethiopia, 2007–2011.
Danielle E. Buttke
- 2013 Active Surveillance for Variant Influenza Among Swine, the Environment, and Employees at Live Animal Markets — Minnesota, 2012.
Mary J. Choi
- 2014 Two Cattle Herdsmen Infected With a Novel Species of Orthopoxvirus — Georgia (county), 2013.
Neil Vora
- 2015 Molecular Epidemiology of *Mycoplasma Pneumoniae* (Mp) During an Outbreak of Mp-Associated Stevens-Johnson Syndrome.
Louise Francois Watkins
- 2016 Legionnaires' Disease Caused by a Cooling Tower — New York City, 2015.
Isaac Benowitz
- 2017 Unusual Pathogen Associated with Nonbiting Flies in a Person with Bacteremia — Washington State, 2016.
Jesse Bonwitt
- 2018 Use of a New Serologic Approach to Identify Avian Influenza A(H7N2) Virus Infections Among Animal Shelter Employees and Volunteers — New York City, 2016–2017.
Eugenie Poirot
- 2019 Coagulopathy Caused by Brodifacoum Rodenticide

Poisoning Among Persons Who Smoke Synthetic Cannabinoids — Wisconsin, 2018.
Erica Wilson

2020 No Award

2021 No Award

Outstanding Poster Presentation Awards, 1986–2021

- 1986 Gender Gap in the Diaper Set: A Closer Look at Differences in Sex-Specific Mortality.
Ray Yip
- 1987 Socioeconomic Differences in Smoking Behavior in Selected States.
Thomas E. Novotny
- 1988 Late-Stage Diagnosis of Breast Cancer Among Women in Low Socioeconomic Groups, Connecticut, 1984–1985.
Thomas A. Farley
- 1989 Malaria Infection in Early Infancy, Malawi.
Laurence Slutsker
- 1990 Seroprevalence of Human Immunodeficiency Virus Type I Among College Students, United States.
Brian R. Edlin
- 1991 Diarrheal Outbreak Associated with a Cyanobacteria (Blue-Green Algae)-Like Body, Chicago.
Philip P. Huang
- 1992 Response to One Dose of Inactivated Poliovirus Vaccine after Three Doses of Oral Poliovirus Vaccine, Abidjan, Côte d'Ivoire.
Bernard J. Moriniere
- 1993 Cholera Outbreak in Rumonge, Burundi.
Maureen E. Birmingham
- 1994 Salivary Testing as an Epidemiologic Tool During an Outbreak of Hepatitis A in an Amish Community in Indiana.
Edmundo Muniz
- 1995 Longitudinal Predictors of Initiation of Smokeless Tobacco Use.
Scott L. Tomar
- 1996 Nonvenomous Animal-Related Fatalities in the U.S. Workplace, 1992–1994.
Constance C. Austin
- 1997 Multidrug-Resistant Pneumococcal Meningitis in a Day Care Center — Tennessee.

- Allen Craig*
- 1998 Beliefs About the Tobacco Industry and Opinions About Anti-Tobacco Policies: How Tight is the Link?
Arthur E. Chin
- 1999 Cold Breakfast Cereal: A New Vehicle Implicated in a Multistate Outbreak of *Salmonella Agona* Infections.
Thomas Breuer
- 2000 Hurricane — Puerto Rico, 1998.
Dan O’Leary
- 2001 Counting Crows: Crow Mortality as a Sentinel for West Nile Virus Disease in Humans — Northeastern United States, 2000.
Kathleen G. Julian
- 2002 Outbreak of Echovirus 18 Meningitis at a Summer Camp — Alaska, 2001.
Joseph B. Mclaughlin
- 2003 Surveillance for Chlamydia in Women — South Carolina, 1998–2001.
Wayne A. Duffus
- 2004 Hospitalizations Associated with Rotavirus Diarrhea — United States, 1996–2000.
Myrna Charles
- 2005 Risk of Secondary Transmission from Imported Lassa Fever — New Jersey, 2004.
Ester Tan
- 2006 Risk Factors for *Helicobacter pylori* in a Rural Community — Montana, 2005.
Elizabeth Melius
- 2007 Outbreak of *Escherichia coli* O157 Associated with Packaged Spinach — Wisconsin, 2006.
Arthur M. Wendel
- 2008 The Power of Combining Routine Molecular Subtyping and Specific Food Exposure Interviews During *Escherichia coli* O157:H7 Outbreak — Minnesota, 2007.
Stacy M. Holzbauer
- 2009 Seroprevalence of Herpes Simplex 2 — National Health and Nutritional Examination Surveys, United State, 2005–2006.
Sara E. Forhan
- 2010 Travelers’ Impressions of 2009 H1N1 Influenza National Health Messaging Campaign.
Emily Jentes
- 2011 *Vibrio mimicus* Infection After Consumption of Crayfish — Spokane, Washington, 2010.
Meagan K. Kay
- 2012 Associations Between *Salmonella* Serotypes and Particular Food Commodities — United States, 1998–2008.
Brendan R. Jackson
- 2013 A Spicy Catch: *Salmonella* Bareilly and Nchanga Infections Associated with Raw Scraped Tuna Product — United States, 2012.
W. Thane Hancock
- 2014 Two Fish, One Fish: Decreasing Number of Outbreaks Attributed to Fish — United States, 1998–2011.
Jolene Nakao
- 2015 Ebola Infection in a Maternity Ward — Tonkolili, Sierra Leone, 2014.
Angela Dunn
- 2016 Increased Cases of Syphilis Among Pregnant Women and Infants — United States, 2012–2014.
Charnetta Williams
- 2017 Seoul Searching: Outbreak of Seoul Virus among Batteries and Pet Owners — Illinois, 2017.
Janna Kerins
- 2018 Multiple Reports of Gastrointestinal Illness at a Hotel and Convention Center — Connecticut, 2017.
Vivian Leung
- 2019 Coccidioidomycosis in U.S. residents returning from house-building trips in Baja California, Mexico, June–July, 2018
Mitsuru Toda
- 2020 No Award
- 2021 No Award

Paul C. Schnitker International Health Awards, 1995–2021

- 1995 Leslie F. Roberts
- 1996 Peter Kilmarx
- 1997 Alexander K. Rowe and Eric L. Mouzin
- 1998 Etienne G. Krug
- 1999 Kayla F. Laserson
- 2000 John MacArthur and Peter Salama
- 2001 Valerie D. Garrett
- 2002 Robert D. Newman and Lorna E. Thorpe
- 2003 Puneet Dewan, Lisa Nelson, and Pratima Raghunathan
- 2004 Tracy Creek
- 2005 Oleg Bilukha
- 2006 Kevin Cain

- 2007 Avid Reza
- 2008 Sapna Bamrah and David Lowrance
- 2009 Rinn Song
- 2010 Andrew Auld
- 2011 W. Roodly Archer
- 2012 Sudhir Bunga and Janell A. Routh
- 2013 Kevin R. Clarke
- 2014 Eugene Lam and Miriam Shiferaw
- 2015 Edna Moturi and Raina Phillips
- 2016 José E. Hagan
- 2017 J. Lyle Conrad (*Official Paul C. Schnitker Committee Historian Award*)
- 2018 Rebecca Casey
- 2018 Rebecca Casey
- 2019 Scott Nabity and Elizabeth Swedo
- 2020 Nirma Bustamante
- 2021 Rachael Zacks

James H. Steele Veterinary Public Health Awards, 1999–2021

- 1999 Fred Angulo and Jordan Tappero
- 2000 David Ashford
- 2001 Kate Glynn
- 2002 Kirk Smith
- 2003 Mike Bunning
- 2004 Jennifer McQuiston
- 2005 John Crump
- 2006 Katherine Feldman and James Kile
- 2007 Jennifer Wright
- 2008 John Dunn
- 2009 Casey Barton Behravesh and Stacy Holzbauer
- 2010 Kendra Stauffer
- 2011 Jennifer Adjemian and Adam Langer
- 2012 Barbara Knust
- 2013 Maho Imanishi and Megin Nichols
- 2014 Danielle Buttke
- 2015 Ryan Wallace
- 2016 Colin Basler and Neil Vora
- 2017 Ilana Schafer
- 2018 Laura Adams and Thomas Doker
- 2019 Caitlin Cossaboom
- 2020 Radhika Gharpure
- 2021 Jesse Bonwitt

Mitch Singal Excellence in Occupational and Environmental Health Awards, 2010–2021

- 2010 Surveillance and Prevention of Occupational Injury Deaths — Wyoming, 2003–2007.
Paul Anderson
- 2011 Unprecedented Outbreak of Acute Childhood Lead Poisoning — Zamfara State, Nigeria, 2010.
Carrie A. Dooyema
- 2012 Pyrrolizidine Alkaloid Toxicity as the Cause of Unknown Liver Disease — Tigray, Ethiopia (2007–2011).
Danielle E. Buttke
- 2013 Impact of Aerial Insecticide Spraying on West Nile Virus Disease — North Texas, 2012.
Duke J. Ruktanonchai
- 2014 Workplace Secondhand Smoke Exposure Among Nonsmoking Women of Reproductive Age — United States, 2010.
Candice Johnson
- 2015 Parking Prices and Walking and Bicycling to Work in U.S. Cities.
Geoffrey Whitfield
- 2016 Cleanliness is Next to Breathlessness: Asthma and Other Health Problems Related to a New Cleaning Product Among Hospital Staff — Pennsylvania, 2015.
Megan Casey
- 2017 Occupational and Take-Home Lead Exposure Associated with a Lead Oxide Manufacturing Plant — North Carolina, 2016.
Jessica L. Rinsky
- 2018 Occupational Exposure to Carbon Disulfide in an Artificial Casing Manufacturing Plant — United States, 2017.
Reed Grimes
- 2019 Use of an Environmental Burden Index for Health Outcome Research — United States, 2018.
Amy Lavery
- 2020 No Award
- 2021 No Award

Stephen B. Thacker Excellence in Mentoring Award, 2013–2021

2013 Stephen B. Thacker
2014 Lyle Conrad
2015 Douglas H. Hamilton
2016 Polly A. Marchbanks
2017 Jennifer McQuiston
2018 James Mercy and William Schaffner
2019 Brenda Rivera-Garcia
2020 Kristine (Kris) Bisgard
2021 John Kobayashi

Shalon M. Irving Health Equity Award, 2018–2021

2018 Francis Annor
2019 Sharoda Dasgupta
2020 Lisa Oakley
2021 Miriam Van Dyke

2022 EIS Conference Abstracts

Monday, May 2, 2022

SESSION A: Stephen B. Thacker Opening Session

12:00–1:45 pm

Moderators: Leslie Dauphin and Patricia Simone

12:05 SARS-CoV-2 Outbreak Among a Highly Vaccinated Population at a Federal Correctional Facility — Texas, July–August 2021

Authors: David W. McCormick, P. Salvatore, L. Hagan, C. Lee, S. Sleweon, L. Nicolae, K. Knipe, T. Dixon, R. Banta, I. Ogle, C. Young, C. Dusseau, S. Salmonson, C. Ogden, E. Godwin, T. Ballom, T. Ross, N. Wynn, E. David, T. Bessey, G. Kim, S. Suppiah, A. Tamin, J. Harcourt, M. Sheth, L. Lowe, H. Browne, N. Thorburg, J. Tate, H. Kirking

Background: People living in congregate settings are at increased risk of SARS-CoV-2 infection. During July–August, 2021, CDC investigated a Delta variant outbreak among 189 persons incarcerated in a federal prison. The extent to which the Delta variant can spread in congregate settings with high vaccine coverage is unclear. We aimed to evaluate the impact of COVID-19 vaccination on SARS-CoV-2 infections in a high-risk congregate setting and to compare viral shedding in unvaccinated and vaccinated cases.

Methods: Outbreak case status and vaccination status for all residents of the four affected housing units was provided by the Bureau of Prisons. After diagnosis, a subset of 95 persons with infection participated in serial, daily mid-turbinate nasal swab collection for real-time reverse-transcription polymerase chain reaction (RT-PCR) and viral culture. Risk of infection by vaccination status was assessed by comparing cumulative incidence proportions (CIP) using Fisher's exact test, and duration of viral shedding was assessed by nonparametric survival analysis.

Results: Among residents of the housing units primarily affected by the outbreak, 172/233 (74%) were infected with SARS-CoV-2. The CIP was higher for unvaccinated persons (39/42, 93%) than fully vaccinated persons (129/185, 70%; $P = .002$). Among 95 persons who participated in daily nasal swab collection, the duration of viral culture positivity was similar for vaccinated ($n = 78$, median 5 days) and unvaccinated persons ($n = 17$, median 5 days, $P = .29$).

Conclusions: Vaccinated and unvaccinated persons had a similar duration of viral shedding. While vaccinated persons had a lower CIP than unvaccinated persons, CIP in both groups were high. As evidence continues to emerge, vaccinated persons should not be considered less infectious for the purposes of public health action. Despite a high proportion of vaccinated persons, multicomponent interventions (e.g., physical distancing, masking, testing, and medical isolation) are critical adjuncts to vaccination in mitigating SARS-CoV-2 outbreaks in high-risk congregate settings.

 Awards presented during session.

12:25 Translocation of a Rabid Anteater Resulting in Multiple Human Exposures — Tennessee, 2021

Authors: Heather N. Grome, J. Yackley, D. Goonewardene, A. Cushing, M. Souza, A. Carlson, L. Craig, B. Cranmore, R. Wallace, L. Orciari, M. Niezgodna, S. Panayampalli, C. Gigante, T. Jones, W. Schaffner, J. Dunn

Background: On August 16, 2021, the Tennessee Department of Health was notified of a positive rabies test from a South American collared anteater (*Tamandua tetradactyla*), a species in which rabies had not previously been reported. The unvaccinated animal was recently transferred to Tennessee from a drive-through style zoo in Virginia and involved multiple people in its care. We investigated to confirm rabies result, characterize rabies variant, and conduct a risk assessment among people potentially exposed.

Methods: Fixed brain tissue was sent to CDC for confirmatory immunohistochemistry testing. Reverse transcriptase-polymerase chain reaction (RT-PCR) of fixed brain tissue and molecular characterization of the rabies virus was conducted. We identified and interviewed persons potentially exposed to the anteater during the rabies viral shedding period (i.e., 14 days before clinical signs [June 16] until date of death [July 6]) and people involved with the necropsy.

Results: Rabies virus antigen was confirmed by immunohistochemistry and by RT-PCR. Molecular characterization identified the virus as most similar to the variant observed in raccoons in Virginia, and divergent from all available sequences from Tennessee. Twenty-two people were identified with potential exposure. Of these, rabies postexposure prophylaxis was recommended to 13 people, including 6 veterinarians, 2 veterinary students, 4 pathologists, and 1 zookeeper. Eleven of these 13 had previously received rabies preexposure vaccination.

Conclusions: This case demonstrates human-mediated rabies translocation through transport of an unvaccinated captive mammal. Expansion of rabies zones through translocation has major public health implications, including potential for epizootics in locations where rabies is not present in native wildlife. Captive mammals not completely excluded from contact with rabies vectors (e.g., raccoons) should be vaccinated. In addition, to decrease risk for human rabies infection it is important for animal handlers at zoologic and veterinary facilities to receive rabies preexposure vaccination.

12:45 Elevated Respirable Crystalline Silica Exposure Among Engineered Stone Fabrication Workers — California, January 2019–February 2020

Authors: Krishna Surasi, B. Ballen, J. Weinberg, B. Materna, R. Harrison, K. Cummings, A. Heinzerling

Background: Silicosis is an irreversible occupational lung disease preventable by controlling exposure to respirable crystalline silica (RCS). Recent studies have reported high prevalence of silicosis among workers fabricating engineered stone, a material with high silica content. Responding to this risk, the California Division of Occupational Safety and Health (Cal/OSHA) performed enforcement inspections at engineered stone fabrication worksites throughout California in 2019 and 2020. We investigated RCS exposures and employer adherence to Cal/OSHA's RCS regulation to assess ongoing risk to workers in the engineered stone fabrication industry.

Methods: We extracted worker personal air sampling results from Cal/OSHA inspection files. We defined RCS exposures per federal and California regulations: 25 $\mu\text{g}/\text{m}^3$ is the action level (AL) and 50 $\mu\text{g}/\text{m}^3$ is the permissible exposure limit

(PEL). Regulations require that employers continue monitoring employee RCS exposures and perform medical surveillance when exposures are at or above AL; exposures above PEL are prohibited. We obtained employer RCS regulation violations from federal OSHA's online inspection database.

Results: We obtained personal air sampling results for 152 employees sure above PEL. Thirty-four (72%) worksites were cited for ≥ 1 RCS regulation violation, most commonly for failure to perform exposure assessment ($n = 32/47$, 68%), communicate RCS hazards to employees ($n = 20/47$, 43%), and perform employee medical surveillance ($n = 17/47$, 36%).

Conclusions: Our investigation demonstrates widespread RCS overexposure and Cal/OSHA regulation violations. Employers in this industry should measure exposures, implement effective controls to lower exposure levels, communicate hazards, and facilitate medical surveillance.

1:05

Long-Term Symptoms by Demographic Characteristics and Underlying Chronic Conditions Among Adults Tested for SARS-CoV-2 — United States, 2020–2021

Authors: Emma K. Accorsi, V. Wanga, S. Aluko, J. Chevinsky, L. Dimitrov, M. Gerdes, R. Bonacci, M. Nji, A. Hernandez-Romieu, J. Rogers-Brown, T. McLeod, J. Rushmore, C. Lutfy, D. Bushman, E. Koumans, A. Goodman, S. Coleman King, J. Cope, S. Saydah

Background: Long-term (lasting >4 weeks since onset) symptoms following SARS-CoV-2 infection are common but not well-characterized. We investigated associations of demographics and underlying chronic conditions with long-term symptoms by SARS-CoV-2 testing status.

Methods: We analyzed data from a non-probability-based Internet survey of 6,021 U.S. adults aged ≥18 years conducted in April 2021 by Porter Novelli through the Lucid platform. Respondents reported ever testing positive (test-positive, n = 698) or always testing negative (test-negative, n = 2,437) for SARS-CoV-2. Using log-Poisson regression, we calculated prevalence ratios (PR) for ≥1 long-term symptom (from an 18-symptom list) comparing test-positive and test-negative respondents, stratified by demographics and underlying chronic conditions. Weighting aligned the sample to U.S. population sex, age, census region, race/ethnicity, and education distributions.

Results: Among test-positive respondents, the prevalence of ≥1 long-term symptom was 65.9% compared to 42.9% among test-negative respondents. The prevalence of ≥1 long-term symptom remained significantly higher for test-positive respondents compared to test-negative respondents across most demographic groups; the largest differences in the prevalence of long-term symptoms were among those with some high school education or less (PR: 2.03; 95% CI: 1.40–2.94), non-Hispanic Black persons (1.91; 1.51–2.42), and adults aged 30–39 years (1.84; 1.60–2.11). Test-positivity was associated with 36% (1.36; 1.26–1.47) and 105% (2.05; 1.69–2.49) increases in the prevalence of ≥1 long-term symptom among those with and without ≥1 underlying chronic condition, respectively. The largest PRs for specific conditions were among respondents who were obese (1.37; 1.15–1.62), had asthma (1.35; 1.15–1.59), or had cancer (1.35; 1.02–1.78).

Conclusions: The widespread occurrence of long-term symptoms across demographic groups suggests that long-term symptoms following SARS-CoV-2 infection may be a broad public health concern. The increased probability of reporting symptoms among adults both with and without underlying chronic conditions is important for clinician awareness.

1:25

Spinal and Disseminated Tuberculosis Caused by Surgical Implantation of a Bone Tissue Product — 20 U.S. States, 2021

Authors: Alfonso C. Hernandez-Romieu, N. Schwartz, W. Wilson, R. Li, M. Deutsch-Feldman, T. Filardo, J. Glowicz, S. Althomsons, R. Free, P. Annambhotla, S. Basavaraju, J. Wortham, S. Bamrah Morris, I. Benowitz, R. Stewart, M. Haddad

Background: U.S. tissue donors undergo limited screening for tuberculosis risk factors; laboratory testing for *Mycobacterium tuberculosis* (*Mtb*) is not routine. On May 25, 2021, a Delaware hospital reported cases of spinal tuberculosis among recipients of a bone tissue product lot containing live cells from a deceased donor. On June 2, the implicated lot was recalled, and another state reported a recipient with tuberculosis. We aimed to determine the source and extent of *Mtb* transmission to recipients and identify measures to prevent contamination of donor-derived tissue products.

Methods: We accounted for and tracked recalled product, notified recipients, and reviewed medical records from the donor and identified recipients. We coordinated mycobacterial testing of recalled product and products from other donors processed at the same facility and compared recalled product and recipient *Mtb* isolates by phylogenetic analysis.

Results: Among 154 product units distributed to 36 facilities in 20 states, 136 were implanted into 113 recipients; the remaining 18 were sequestered. Eight recipients died before notification; 105 living recipients initiated treatment. Among 113 recipients, 87 (77%) developed spinal or disseminated tuberculosis, and 49 (43%) underwent surgery for product-related complications. The donor had tuberculosis risk factors (e.g., diabetes and prior residence in a country with a tuberculosis incidence of 20–50 per 100,000 persons) and symptoms consistent with active disease. *Mtb* was detected in recalled product but not in products from other donors; recalled product and recipient isolates were >99.99% similar.

Conclusions: Donor tissue containing live cells infected with *Mtb* manufactured into a multiunit product resulted in the first tissue-derived tuberculosis outbreak in the United States. Rapid public health response likely prevented additional morbidity through sequestration of unused product and treatment of recipients. Screening of donors for tuberculosis risk factors and symptoms to guide prompt *Mtb* evaluation and testing could avert substantial morbidity and mortality.

CONCURRENT SESSION B1: Social and Health Inequity

2:15–3:40 pm

Introduction: Leandris Liburd

Moderator: Brooke Hoots

2:20 HIV Outbreak Among People Who Inject Drugs — Kanawha County, West Virginia, 2019–2021

Authors: Rebecca B. Hershov, S. Wilson, R. Bonacci, M. Deutsch-Feldman, O. Russell, S. Young, S. McBee, E. Thomasson, S. Balleydier, M. Boltz, V. Hogan, A. Atkins, N. Worthington, R. McDonald, M. Adams, D. Bixler, A. Moorman, S. Kowalewski, M. Salmon, R. McClung, A. Oster, K. Curran

Background: In 2019, the West Virginia Bureau for Public Health (WVBPH) noted an increase in HIV diagnoses among persons who inject drugs (PWID) in Kanawha County, West Virginia (WV), an area with historically few HIV diagnoses but high fatal drug overdose rates. In June 2021, WVBPH and CDC conducted an investigation to characterize the outbreak, identify service barriers, and inform response activities.

Methods: Outbreak cases were defined as confirmed HIV diagnoses between January 1, 2019 and October 27, 2021 in PWID who lived in Kanawha County at the time of diagnosis. We described WV HIV surveillance data and interviewed 26 PWID and 45 community partners recruited through purposive sampling.

Results: Of 85 persons who met the case definition, 44 (52%) were male, 67 (79%) were aged 20–39 years at diagnosis, and 77 (91%) identified as non-Hispanic White. Of 80 living persons, 20 (25%) had an HIV care visit in the last 90 days. Qualitative results indicated PWID had limited access to sterile syringes and syringe services programs (SSPs) because of some community opposition and recent legislation restricting SSPs. In health care settings, barriers to HIV services included medical mistrust because of prior mistreatment by providers, infrequent HIV screening, and limited treatment for opioid use disorder. PWID often experienced co-occurring homelessness, mental illness, and acute medical conditions, posing challenges for providers to reach PWID and prioritize HIV services.

Conclusions: PWID experienced limited access to HIV prevention and treatment because of policy-, community-, and health systems-level barriers. Based on investigation findings, CDC recommended expanding HIV testing and access to sterile syringes through comprehensive harm reduction services and improving integration of medical and social services. Low-barrier one-stop shop models that offer infectious disease prevention, harm reduction, and social services might improve HIV services for PWID.

2:40

Homicides of Black Males Across the Lifespan: Findings from the National Violent Death Reporting System — 2003–2019

Authors: Miriam E. Van Dyke, K. Sheats, R.F. Wilson, J. Blair, A. Crosby

Background: In 2019, homicide was the 15th leading cause of death among all males, but 5th among Non-Hispanic Black males. Structural inequities and racism are associated with this disparity. To inform prevention, we described circumstances of homicides of Black males across the lifespan using CDC's National Violent Death Reporting System (NVDRS).

Methods: NVDRS is a state-based surveillance system that collates violent death data from death certificates, coroner/medical examiner reports, and law enforcement reports. We described characteristics of homicides/legal intervention deaths of Black males across eight age groups, using 2003–2019 NVDRS data.

Results: During 2003–2019, NVDRS captured 52,434 homicides/legal intervention deaths (3.1% legal intervention) among Black males. Victims aged 25–34 years (33%) and 18–24 years (30%) accounted for the greatest proportion of deaths. Among victims aged ≥ 18 years, 68% had a high school

diploma/equivalent or more education. The most common method of injury was firearms (84%). The most common injury location among victims aged 10–17 (42%) and 18–24 years (36%) was street/sidewalk/alley and among victims of other ages was house/apartment (34–89%). Homicides were precipitated by another crime for 33–46% of victims aged ≥ 10 years. Caregiver abuse/neglect was indicated in 84% of homicides of victims aged < 10 years.

Conclusions: Homicides of Black males most often occurred among victims aged 18–34 years, in community settings, and resulted from firearm injuries. Child homicides were most often the result of child abuse and neglect. Homicide circumstances across the lifespan can inform strategies that address proximal risks and the underlying structural (e.g., income, education, and employment) inequities and racism experienced by Black males. The results support a comprehensive approach including policies (e.g., strengthen economic supports to families) and programs (e.g., street outreach) that create protective environments and connect young people with community resources.

3:00

Impact of Pneumococcal Conjugate Vaccines on Differences in Invasive Pneumococcal Disease Between Black and White Persons — United States, 2008–2019

Authors: Emma K. Accorsi, R. Gierke, M. Farley, H. Talbot, A. Thomas, A. Reingold, L. Harrison, C. Holtzman, K. Burzlaff, S. Petit, M. Barnes, S. Shrum, S. Chochua, T. Pilishvili

Background: Black persons have higher rates of invasive pneumococcal disease (IPD) than White persons in the U.S. Introduction of 13-valent pneumococcal conjugate vaccine (PCV13) for children in 2010 reduced overall IPD and racial differences in rates. Two higher-valency vaccines (PCV15, PCV20) were recommended for adults in 2021; licensure for children is expected by 2023. We assessed remaining disparities in PCV13-type IPD rates and the potential for new PCVs to further reduce racial disparities.

Methods: IPD cases were identified through CDC's Active Bacterial Core surveillance and defined as isolation of pneumococcus from a normally sterile site. We compared incidence rates (per 100,000) in 2008–2009 (pre-PCV13) to 2018–2019 by age group and race and calculated rate differences (RD) by race in 2018–2019. Analysis was limited to Black and White persons and did not group by ethnicity.

Results: From the pre-PCV13 period to 2018–2019, overall IPD rates fell from 20.3 to 12.6, and 10.9 to 7.9 in Black and White persons, respectively, with declines seen across all age groups. Driving this trend, PCV13-type IPD rates fell from 10.1 to 2.9 and 6.3 to 2.3 for Black and White persons, respectively. Non-PCV13-type IPD rates remained steady over this period. In 2018–2019, overall IPD rates were 1.6 times higher in Black compared to White persons (RD: 4.7). RDs by race in PCV13-type IPD were $< 1/100,000$, except in adults 50–64 years (RD: 3.3). In 2018–2019, rates of PCV15/non-PCV13-type and PCV20/non-PCV13-type IPD among Black persons were 1.6 and 3.4, respectively, compared to 1.2 and 2.3 among White persons, with adults 50–64 years showing the largest RDs by race.

Conclusions: PCV13 decreased overall and PCV13-type IPD among Black and White persons and reduced racial differences across all age groups. New higher-valency PCVs can further reduce these disparities, especially in adults.

Authors: Hannah G. Rosenblum, J. Gargano, A. Cleveland, R. Dahl, I. Park, N. Bennett, J. Castilho, L. Niccolai, E. DeBess, E. Unger, L. Markowitz

Background: Although invasive cervical cancer (ICC) rates have declined since the advent of screening, the annual age-adjusted rate of cervical cancers in the United States remains 7.5 per 100,000 women. Previous studies demonstrate that failures of recommended screening and management often precede ICC diagnoses. Screening should detect asymptomatic disease; symptoms at diagnosis suggest missed opportunities for interventions. We evaluated characteristics of women with ICC, including potential barriers to accessing preventive care.

Methods: We abstracted medical records for patients with ICC identified 2008–2020 in five U.S. population-based surveillance sites covering 1.5 million women. We identified chart-based evidence of social and medical conditions we hypothesized may present barriers to effective screening and management. We calculated descriptive frequencies and compared barriers among women presenting with and without symptoms using chi-square tests.

Results: Among 1495 women with ICC (median age: 49 years; Non-White: 34.4%; stage I: 56.6%), the majority (60.3%) presented with symptoms, most commonly vaginal bleeding, pelvic pain, or a mass. Half (48.2%) had ≥ 1 identified barrier; 20.1% had multiple barriers. The most common barriers among all women were being underinsured (16.1%), language (15.3%), and serious mental illness (9.1%). Presence of any barrier was more frequent among women with than without symptoms (58.8% vs. 32.8%, $P < 0.0001$). Being uninsured, language barriers, and chronic medical conditions were at least twice as frequent among symptomatic women (all $P < 0.01$).

Conclusions: This population-based descriptive study helps explain why invasive cervical cancer, preventable with widely available screening, is still occurring in the United States. The prevalence of potential barriers is likely an underestimate because some might not be documented in medical charts. Interventions to increase appropriate cervical cancer screening and management, particularly for those who may be underinsured, have competing health priorities, or are otherwise underserved in the medical system, are important for reducing cervical cancer rates.

CONCURRENT SESSION B2: Pregnancy, Childhood, and Adolescence

2:15–3:40 pm

Introduction: Karen Remley

Moderator: Michelle Hughes

2:20 Alcohol Consumption Among Pregnant People Aged 18–49 Years — United States, 2018–2020

Authors: Lucas K. Gosdin, N. Deputy, S. Kim, E. Dang, C. Denny

Background: Alcohol consumption during pregnancy can cause fetal alcohol spectrum disorders, miscarriage, and stillbirth. During 2015–2017, prevalence estimates of current and binge drinking among pregnant people aged 18–44 years in the U.S. were 11.5% and 3.9%, respectively. More recent estimates of the prevalence and correlates of alcohol consumption are needed to inform public health efforts.

Methods: Data from the 2018–2020 Behavioral Risk Factor Surveillance System (representative of 50 states and the District of Columbia), were analyzed to estimate the prevalence of self-reported current drinking (≥ 1 alcoholic drink) and binge drinking (≥ 4 drinks on at least one occasion) over the past 30 days among pregnant people aged 18–49 years overall and by selected characteristics. Sociodemographic and health characteristics examined were age, race/ethnicity, education, employment status, marital status, having a usual healthcare provider, and frequent mental distress (≥ 14 days of poor mental

health in past 30 days). Multivariable regression, accounting for complex sampling and using population weights, was used to estimate adjusted prevalence ratios (aPRs) to identify factors associated with current and binge drinking.

Results: Of 6,327 pregnant people in this analysis, 13.5% reported current drinking and 5.2% reported binge drinking. Notably, those reporting frequent mental distress had over twice the prevalence of current drinking [aPR: 2.3 (1.7–3.1)] and over three times the prevalence of binge drinking [aPR: 3.4 (1.9–5.8)] compared with their counterparts. Pregnant people without a usual healthcare provider more commonly reported current drinking [aPR: 1.7 (1.2–2.3)] than those with one.

Conclusions: Alcohol consumption during pregnancy continues to be a serious problem. Addressing it requires evidence-based clinical interventions such as alcohol screening and brief intervention and community-wide strategies such as limits on alcohol sales. Improved access to care, including mental health services, may reduce prenatal alcohol exposure and prevent poor pregnancy and birth outcomes.

2:40

Clusters of SARS-CoV-2 Infection Associated with K-12 Public School Settings — Wyoming, August 1, 2020–May 31, 2021

Authors: Christine J. Atherstone, S. Madni, A. Harrist, E. Thomas, J. Neatherlin, A. Busacker

Background: Understanding SARS-CoV-2 transmission in school settings is critical to maintaining in-person learning. We aimed to describe risk factors for school-associated COVID-19 clusters, especially those with significant secondary transmission.

Methods: Using state-wide retrospective case investigation data collected from August 1, 2020–May 31, 2021, a line list of school-associated cases and their contacts, categorized by exposure type (e.g., household, community, within school, athletic, unknown), was created for social network analysis. Descriptive statistics were calculated to characterize clusters (size, exposure and school type). A cluster was defined as three or more epidemiologically linked school-associated cases. Univariate and multivariate analyses were used to explore association between clusters and type of school (elementary, middle or high school) or exposure.

Results: We identified 43 clusters involving 504 individuals from 51 schools. Clusters contained multiple exposure types; athletic exposures (35 clusters involving 142 individuals) and within-school exposures (classroom, lunch; 10 clusters involving 42 individuals) were connected with 81% and 23% of clusters, respectively. Clusters ranged in size from 3–40 individuals (mean: 11.7); 88.3% included household/family members (38 clusters involving 199 individuals). High schools were 3.8 times (95% CI: 1.8–8.0) more likely to be associated with a cluster than middle or elementary schools. Fourteen schools (27.5%) experienced ≥ 2 clusters; more than a third of clusters involved ≥ 2 school types ($n = 15$, 37.8%). Cluster size was not associated with type of school or exposure.

Conclusions: COVID-19 clusters occurred across different school types with a majority associated with athletics. Reducing transmission in these school settings is crucial. Quarantine and isolation as a result of outbreaks among athletes can impact in-person learning for all students. Future analyses to explore the association between additional school demographics, prevention measures implemented and variant involved may further our understanding of risk factors for school-associated COVID-19 clusters.

3:00

Immunogenicity of Quadrivalent Human Papillomavirus Vaccine Among Alaska Native Children Aged 9–14 Years at 5 Years After Vaccination — Alaska, 2011–2019

Authors: Bionca M. Davis, D. Bruden, G. Panicker, E. Meites, G. Thompson, J. Geis, M. Fischer, E. Unger, L. Markowitz, M. Bruce

Background: Human papillomavirus (HPV) causes an estimated 35,900 anogenital or oropharyngeal cancers annually in the United States. HPV vaccines are highly effective for preventing new HPV infections. Studies suggest long-term persistence of vaccine-induced antibodies. However, data are limited among Alaska Native people.

Methods: During 2011–2014, we enrolled Alaska Native children aged 9–14 years who received a 3-dose series of quadrivalent HPV vaccine (4vHPV). We collected sera at 1 month and 1-, 2-, 3-, and 5-years post-vaccination and used a multiplex virus-like particle enzyme-linked immunosorbent assay to measure type-specific immunoglobulin G titers for the 4vHPV types (HPV-6/11/16/18). We determined the proportion of participants with detectable antibodies (≥ 0.1 arbitrary units [AU]/ml for anti-HPV-6/11, ≥ 0.5 international units [IU]/ml for anti-HPV-16, ≥ 0.4 IU/ml for anti-HPV-18) at each timepoint

and used geometric mean concentrations (GMCs) and 95% confidence intervals (CI) to assess trends in antibody levels.

Results: Among 473 participating children (402 female, 71 male), 435 (92%) completed the 1-month and 348 (74%) completed the 5-year visit. All had detectable antibodies against the 4vHPV types at all timepoints post-vaccination. GMCs for all types were highest at the 1-month visit. At 5 years post-vaccination, GMCs were 20 AU/ml, 24 AU/ml, 111 IU/ml, and 33 IU/ml for HPV-6/11/16/18, respectively. For anti-HPV-16, GMCs declined from 1,240 IU/ml (95% CI: 1,127–1,365) at 1-month post-vaccination to 230 IU/mL (95% CI: 205–259) at 1 year, 171 IU/mL (95% CI: 152–192) at 2 years, 137 IU/mL (95% CI: 122–155) at 3 years, and 111 IU/mL (95% CI: 99–125) at 5 years. Trends in antibody levels from 1-month to 5-years post-vaccination were similar for the other three 4vHPV types.

Conclusions: Alaska Native children maintained antibodies against all 4vHPV types at 5-years post-vaccination. Antibody levels peaked by 1-month post-vaccination, declined substantially during the next year, and gradually declined in subsequent years.

Authors: Melanie J. Firestone, S. Holzbauer, K. Smith, R. Danila, R. Bitsko, C. Conelea, S.M. Klammer, S. Gingerich, R. Lynfield

Background: Since the COVID-19 pandemic began, clinicians have reported an increase in young persons with functional tic-like behaviors (FTLBs). On October 15, 2021, the Minnesota Department of Health began investigating a cluster of FTLBs among adolescent girls at a school, possibly related to COVID-19.

Methods: Affected students or proxies were interviewed with a questionnaire about symptoms, medical history, exposures, including depression (Patient Health Questionnaire-9) and anxiety (Generalized Anxiety Disorder-7) screens. Cases were defined as rapid onset of FTLBs lasting >24 hours during September–November 2021.

Results: Eight cases were identified (symptom onsets: September 26–October 30, 2021). All reported simple motor tics (i.e., eye blinking, head jerks, shoulder shrugs, or abdominal tensing); two also reported complex vocal tics

(i.e., syllables or phrases). Median symptom duration at time of interview was 7 days (range: 3–24 days); only 1 student's symptoms had resolved. None had a previous tic disorder diagnosis. Six (75%) students reported a sore throat <3 months before FTLB onset. Four students reported previously having COVID-19, ranging from >1 year before tic symptom onset to the time of tic symptom onset. Five students were previously diagnosed with anxiety and 4 with depression. Among students without a previous anxiety or depression diagnosis, 2 of 3 scored as having moderate or severe anxiety, and 3 of 4 as having moderate or moderately severe depression. All 8 students participated in extracurricular activities with or were acquaintances of ≥ 1 other affected student. Students were referred to mental health professionals for evaluation. Parents and school staff were offered an FTLBs educational webinar.

Conclusions: We report a FTLBs cluster in a small school with interaction among affected students. Medical history included depression or anxiety more frequently than prior COVID-19 infection. Consistent with previous reports, FTLBs may be related to pandemic-related exacerbation of anxiety and depression.

CONCURRENT SESSION B3: COVID-19-Associated Outcomes

2:15–3:40 pm

Introduction: Barbara Mahon

Moderator: Kris Bisgard

2:20 Health Outcomes After Hospital Discharge and Response to COVID-19 Vaccination in Children with a History of Multisystem Inflammatory Syndrome — United States, 2020–2021

Authors: Amber Kunkel, A. Yousaf, K. Arnold, S. Godfred-Cato, A. Shah, J. Abrams, T. Hammett, E. Koumans, S. Bamrah Morris, A. Campbell, E. Belay

Background: Multisystem inflammatory syndrome in children (MIS-C) is a rare but serious condition following SARS-CoV-2 infection. As of November 30, 2021, 5,973 MIS-C cases were reported to CDC national surveillance. The inflammatory response and multi-organ dysfunction exhibited by children with MIS-C after SARS-CoV-2 infection raise questions about long-term health outcomes and safety of subsequent COVID-19 vaccination. This abstract describes health outcomes of patients with MIS-C following hospital discharge and adverse events (AEs) following subsequent COVID-19 vaccination.

Methods: A follow-up study was conducted on children aged <21 years who were hospitalized with MIS-C at 3 children's hospitals from March 2020–February 2021. Consenting families were interviewed 7–15 months after discharge about the child's physical and mental health status at 6 months post-discharge, COVID-19 vaccination status, and vaccine AEs. Medical records were abstracted to collect data from follow-up outpatient visits and subsequent hospitalizations.

Results: As of November 29, 2021, 45 patients had ≥1 interview (N = 25) or chart abstraction (N = 28) completed. Within 8 weeks of discharge, 19/28 (68%) patients had ≥1 echocardiogram recorded, of which 3 (16%) had abnormal findings. Six months post-discharge, 18/25 (72%) interviewees reported a return to pre-hospitalization physical health, and 17/25 (68%) to pre-hospitalization mental health (including coping with stress, frustration, and emotions). Symptoms most reported were tiredness/fatigue (6/24; 25%), “brain fog” (5/24; 21%), and depression/anxiety (5/25; 20%). Nine patients received ≥1 COVID-19 vaccine 7–59 weeks after discharge. Among these children, 5 (56%) reported headache, 3 (33%) reported body aches, 1 (11%) reported chills, and 1 (11%) reported rash for 1–3 days following vaccination; none required medical attention.

Conclusions: Preliminary results indicate that about 70% of children with MIS-C recover fully within 6 months of hospital discharge. None of the 9 children vaccinated after MIS-C reported an adverse event requiring medical attention.

2:40

Post-COVID Condition Symptom Clusters and Associations with Return to Pre-COVID Health — Results from a 2021 Multi-State Survey

Authors: Stacey L. Konkle, R. Magleby, H. Segaloff, P. Mahale, B. Katic, L. Dimitrov, M. Nji, D. Bushman, R. Bonacci, A. Hernandez-Romieu, J. Rushmore, J. Chevinsky, J. Brown, B. Cadwell, J. Cope, B. Jackson, S. Coleman King, B. Belay, J. Ko, S. Saydah

Background: While longer term consequences of SARS-CoV-2 infection are still being understood, initial reports indicate that persons may experience post-COVID conditions (PCC) ≥ 4 weeks after infection. We identified PCC symptom clusters and described clusters associated with not returning to pre-COVID physical and mental health.

Methods: Persons aged ≥ 18 years who met CSTE probable or confirmed COVID-19 case definitions during March–December 2020 were selected from state case-investigation databases and sent a multi-state electronic survey designed to assess presence and types of PCC symptoms. We used factor analysis to identify clusters of PCC symptoms and logistic regression models to estimate the association of each PCC symptom cluster with return to pre-COVID physical and mental health.

Results: Of $\sim 55,000$ surveys sent, 4267 were returned for analysis. Thirty-seven percent (1559/4267) of respondents self-reported PCC. Four PCC symptom clusters were identified: *myalgic encephalomyelitis/chronic fatigue syndrome-like* (ME/CFS-like) ($n = 1214$), digestive ($n = 390$), changes in taste/smell ($n = 622$), and upper respiratory ($n = 437$). Seventy one percent (1109/1559) and 52% (807/1559) of respondents with PCC reported not returning to pre-COVID physical or mental health ≥ 4 weeks after infection, respectively. ME/CFS-like (OR: 7.0; 95% CI: 4.8–10.2), digestive (OR: 2.1; 95% CI: 1.4–3.0), and upper respiratory (OR: 2.4; 95% CI: 1.7–3.4) symptom clusters were associated with not returning to pre-COVID physical health. Not returning to pre-COVID mental health was associated with ME/CFS-like (OR: 5.6; 95% CI: 3.8–8.4), digestive (OR: 2.7; 95% CI: 1.9–3.7), and upper respiratory (OR: 1.9; 95% CI: 1.4–2.5) symptoms clusters.

Conclusion: Not returning to pre-COVID physical and mental health were common among survey respondents. Digestive, upper respiratory, and particularly ME/CFS-like symptoms were associated with not returning to pre-COVID states of health, suggesting the value of monitoring for these symptoms and insuring that appropriate medical or mental care is accessible for persons with PCC.

3:00

COVID-19 Mortality Surveillance Using Death Certificates and Time Elapsed Between Positive Molecular Test and Death — California, June 2021

Authors: J. Bradford H. Bertumen, B. Bregman, E. Silver, J. Openshaw, J. deJarnette, N. Deot, D. Melton, S. Chai, P. Barry, S. Jain, J. Watt

Background: Accurate, timely COVID-19 mortality surveillance is needed to monitor pandemic severity and guide mitigation strategies. Since March 2020, the California Department of Public Health has tracked COVID-19-associated deaths based on the gold standard method: local health jurisdiction (LHJ) determination which utilizes the CSTE definition of a person who died with a positive molecular result (i.e., positive PCR test) as well as further case investigation of data such as medical records, provider interviews, etc. if needed. We compared gold standard confirmed COVID-19-associated deaths in California to a method using only death certificates and laboratory information to assess its usefulness as a potential mortality surveillance tool.

Methods: We matched gold standard confirmed COVID-19-associated deaths in California occurring in June 2021 to death certificates. Laboratory information was obtained from statewide electronic laboratory reports. For death

determination, deaths were considered COVID-19-associated if COVID-19 or a related complication was listed on the death certificate; or occurred within 60 days of last positive molecular result. The sensitivity of this surveillance method was calculated.

Results: We identified 348 gold standard confirmed COVID-19-associated deaths in June 2021; 295 deaths were confirmed using the death certificate/molecular result method (84.8% sensitivity). Fifteen (4.3%) deaths had an alternative cause of death without COVID-19 on the death certificate, and 38 (10.9%) occurred ≥ 60 days after last positive test.

Conclusions: Based on review of one month of confirmed COVID-19-associated deaths in California, surveillance using only death certificates and time elapsed between last positive molecular result and death captured over four-fifths of the deaths, with the gold standard surveillance method needed to confirm the remaining deaths. Death certificates and molecular testing data may make COVID-19 mortality surveillance more timely and less labor-intensive and could be used in conjunction with the gold standard method.

Authors: Theresa M. Dulski, M. DeLong, K. Garner, N. Patil, M. Cima, L. Rothfeldt, T. Gulley, A. Porter, K. Vyas, H. Liverett, M. Toda, J. Gold, A. Kothari

Background: Mucormycosis is a severe invasive fungal infection typically affecting persons with immunocompromising conditions. During the SARS-CoV-2 Delta variant surge in September 2021, clinicians notified the Arkansas Department of Health (ADH) of multiple patients with mucormycosis following COVID-19 diagnoses. COVID-19–associated mucormycosis (CAM) has been infrequently reported in the United States. To inform clinical and public health practice, ADH coordinated a statewide call for CAM cases.

Methods: A case of mucormycosis was defined as laboratory identification of Mucorales by culture, histopathology, or polymerase chain reaction (PCR) in a patient with a mucormycosis diagnosis. Cases were considered COVID-19–associated if the patient received a positive reverse transcription-PCR or antigen result for SARS-CoV-2 ≤ 60 days preceding mucormycosis diagnosis. Cases were reported via standardized form, medical records, and verbal report. Data were linked to state vital records, and immunization and COVID-19 registries.

Results: Ten CAM cases, occurring during July 12–September 28, 2021, were reported by six hospitals. Patients' median age was 57 years (range: 17–78 years). Eight patients had diabetes (hemoglobin A1c range: 6.0%–14.3%). One patient had a history of solid organ transplantation; one patient had a recent traumatic injury at the body site where mucormycosis developed. No patients were vaccinated against COVID-19. COVID-19 treatment included supplemental oxygen (eight), corticosteroids (nine), tocilizumab (two), and baricitinib (two). The most common mucormycosis presentation was rhino-orbital infection (four, including three with cerebral involvement). Six patients died during or soon after hospitalization.

Conclusion: Ten CAM cases were reported during a period coinciding with a statewide surge in COVID-19 cases and might be related to COVID-19–induced immune dysregulation or treatments. Clinicians should maintain high index of suspicion for CAM, including in patients without severe immunocompromising conditions. COVID-19 vaccination, maintenance of glycemic control in patients with diabetes, and judicious use of corticosteroids should be encouraged.

SESSION C: J. Virgil Peavy Memorial Award Finalists

4:10–5:35 pm

Introduction: Daniel Jernigan

Moderator: Byron Robinson

4:15 Effectiveness of Pfizer-BioNTech COVID-19 Vaccine to Prevent SARS-CoV-2 Infection Among Long-Term Care Facility Staff With and Without Prior Infection — New York City, January–June 2021

Authors: Kathryn Peebles, R. Arciuolo, A. Romano, J. Sell, S. Greene, S. Lim, C. Mulready-Ward, A. Ternier, B. Badenhop, K. Blaney, J. Real, M. Spencer, T. McPherson, S. Ahuja, J. Sullivan Meisner, J. Zucker, J. Rosen

Background: Evidence of the protective effect of COVID-19 vaccination among persons with a prior SARS-CoV-2 infection is limited. Many long-term care (i.e., skilled nursing and adult care) facility (LTCF) staff in New York City (NYC) were infected before vaccine availability, and all were subject to state-mandated weekly molecular SARS-CoV-2 testing, providing a unique opportunity to evaluate the protective effect against incident SARS-CoV-2 infection of (1) prior infection without vaccination, (2) full vaccination after prior infection, and (3) full vaccination without prior infection, all compared to unvaccinated persons without prior infection.

Methods: We estimated effectiveness of full vaccination with Pfizer-BioNTech COVID-19 vaccine (≥ 14 days post-dose two) among LTCF staff aged < 65 years during 1/25/2021–6/5/2021. SARS-CoV-2 test results were obtained from state-mandated laboratory reporting. Vaccination status and date were obtained from the NYC Citywide Immunization Registry. Cox

proportional hazards models included inverse probability of exposure weights to adjust for potential confounders, including race/ethnicity (imputed when missing using Bayesian Improved Surname Geocoding), age, borough, and calendar week. We used Rubin's Rules to calculate pooled and adjusted effect estimates.

Results: Among 7,763 persons in 179 LTCFs, 5,400 (69.6%) had documented prior infection; 90% of prior infections occurred > 7 months before the study period. Relative to unvaccinated persons without prior infection, unvaccinated persons with a prior infection had a 55% (95% CI: 38%–67%) reduced risk of infection. Full vaccination of previously infected persons reduced infection risk by 82% (95% CI: 71%–89%). Among persons without prior infection, full vaccination reduced infection risk by 80% (95% CI: 68%–88%).

Conclusions: Full vaccination reduced SARS-CoV-2 infection risk by $\geq 80\%$ among all persons, and for those with a prior infection, significantly increased the protection conferred by prior infection alone. These findings support CDC recommendations that all eligible persons, regardless of prior infection, be vaccinated against COVID-19.

Authors: Marisa A.P. Donnelly, G.L. Sondermeyer Cooksey, A. Nguyen, A. Yu, D.J. Vugia, S. Jain

Background: Coccidioidomycosis is a fungal infection caused by soil-dwelling *Coccidioides immitis* or *posadasii*, which people can contract by inhaling spores from the environment. Although most infected persons recover without symptoms or with mild illness, ~1% of patients develop severe disseminated disease that can result in death. In California, incidence rates are highest among persons aged 40–59 years and people who self-identify as Black or Hispanic or Latino. We sought to estimate association between coccidioidomycosis incidence rates and California’s Healthy Places Index (HPI), a metric of community health, to guide public health practice and messaging toward less advantaged populations in California.

Methods: We analyzed California coccidioidomycosis cases reported during 2000–2019. Patients’ residential addresses were geocoded, linked to data from the 2010 census, and categorized into 4 HPI quartiles based on census tract HPI score. Tracts in the lowest scoring HPI quartile (HPI 1) are less advantaged

as measured by 25 health equity variables. For each HPI quartile, we calculated age-adjusted incidence by sex, age, and race. Multivariable negative binomial regression was used to calculate incident rate ratios and assess trends.

Results: In total, 74,622 coccidioidomycosis cases were reported in California during 2000–2019; incidence rate/100,000 population was highest among people aged 40–59 years (11/100,000 population), males (10.6/100,000 population), and persons aged 20–39 years (9.3/100,000 population). Overall, incidence was highest in HPI 1 and decreased with increasing HPI scores (incidence rate ratio HPI 1 vs. HPI 4 = 7.03, $P < 0.001$). When stratifying by HPI, the highest incidence rate was for persons aged 40–59 years in HPI 1 (21.7/100,000 population).

Conclusions: In California, coccidioidomycosis incidence rates were highest in less advantaged communities. Socially and culturally appropriate guidance for coccidioidomycosis outreach programs, testing, and treatment should be strengthened for these communities.

Authors: Peter M. DeJonge, N. Klozcko, C. Tomasallo, J. Meiman

Background: Preliminary research indicates positive correlation between COVID-19 cases and quantitative SARS-CoV-2 wastewater concentrations in a community. However, the effect of wastewater surveillance methods on this correlation is unknown. Wisconsin’s expansive network of wastewater surveillance systems provided an opportunity to investigate predictors of correlation, including wastewater sampling frequency, laboratory methods, and watershed population size.

Methods: During January 20–October 31, various wastewater treatment plants (WTPs) throughout Wisconsin routinely sent wastewater samples to one of two state laboratories where they were tested for SARS-CoV-2 genetic material (either reverse transcription polymerase chain reaction or digital droplet PCR [dd-PCR]). We linked Wisconsin COVID-19 cases to participating WTP sewersheds using residential addresses. Spearman rank correlation and weighted Cohen’s kappa tests were used to evaluate agreement between WTP-linked cases and wastewater concentrations (viral geometric mean concentration per person). Assessed predictors of agreement

included wastewater sampling frequency at WTPs, laboratory method, and WTP sewershed population size.

Results: We compared wastewater and COVID-19 case data associated with 61 WTPs, serving 52% of Wisconsin’s population. These WTPs differed in average days between samples (mean: 5.3; range: 1.3–7.7), use of dd-PCR ($n = 11$, 22%), and watershed population size (mean: 49,456, range: 1,900–615,934). Average Spearman values across all WTPs—the mean within-WTP sewershed correlation across the entire surveillance period—was positive (mean: 0.46; standard deviation: 0.23). Cohen’s kappa—a summary of daily within-WTP data agreement—indicated that data from WTPs serving populations $\geq 42,400$ people and those sampling wastewater ≥ 1 time/week had significantly higher agreement ($P < .05$). Neither lab method was not significantly associated with improved agreement.

Conclusions: WTPs that sampled more frequently and served larger populations had higher surveillance data agreement with COVID-19 case prevalence in their communities. Health departments interested in bolstering their methods to monitor community COVID-19 prevalence should consider testing wastewater for SARS-CoV-2 at least once per week.

Authors: Laura Ford, J. Healy, Z. Cui, L. Ahart, F. Medalla, L. Ray, J. Reynolds, M. Laughlin, D. Vugia, S. Hanna, C. Bennett, J. Chen, D. Payne, L. Francois Watkins

Background: *Campylobacter* is the most common cause of bacterial diarrhea; resistance to macrolides and fluoroquinolones limits treatment options. The Foodborne Diseases Active Surveillance Network (FoodNet) has reported a higher incidence of *Campylobacter* every year since culture-independent diagnostic tests (CIDs) were introduced in 2012. We applied new methodology to describe trends in *Campylobacter* infections.

Methods: FoodNet receives information on laboratory-confirmed *Campylobacter* cases from 10 US sites. The National Antimicrobial Resistance Monitoring System receives a subset of isolates from FoodNet sites for antimicrobial susceptibility testing. We used a Bayesian mixed effects model to estimate trends in *Campylobacter* incidence, adjusting for surveillance changes attributable to CIDs. We linked culture-confirmed cases with resistance data and used binomial log-linear models to compare percentages of isolates resistant to erythromycin or ciprofloxacin during 2005–2016 to 2017–2018, stratified by demographics and travel. We used multivariable logistic

regression to examine the association of international travel with resistance.

Results: Adjusted *Campylobacter* incidence decreased on average–2.9% (95% Credible Interval: -4.1%–-1.5%) annually since 2012. Among 12,189 isolates in 2005–2016 and 2,449 isolates in 2017–2018, the percentage of resistant infections increased from 2.6% to 3.3% for erythromycin ($P = .036$) and from 24.5% to 29.7% for ciprofloxacin ($P < .001$). The increase in erythromycin-resistant infections remained significant when stratified among males, children <5 years, Whites, and Hispanics; the increase in ciprofloxacin-resistant infections remained significant for most groups. Travelers were more likely than non-travelers to have infections resistant to erythromycin (adjusted odds ratio [aOR]: 1.7; 95% CI: 1.4–2.4) or ciprofloxacin (aOR: 6.0; 95% CI: 5.4–6.7), with risk highest after travel to Asia for both.

Conclusions: Our model indicates that *Campylobacter* incidence actually decreased, after adjusting for use of CIDs. However, the percentage of isolates resistant to antibiotics recommended for treatment has increased. International travel increased the risk of resistant infection.

CONCURRENT SESSION D1: Global Health

11:30 am–12:55 pm

Introduction: Kevin Cain

Moderator: Kevin Clarke

11:35 Strong Father-Child Relationships Moderate the Association Between Adverse Childhood Experiences and HIV Acquisition Risk Among Young Women — Namibia, 2019**Authors:** Nickolas T. Agathis, F.B. Annor, G.M. Massetti

Background: Exposure to violence and other adverse childhood experiences (ACEs) are associated with increased HIV acquisition risk among young women in high HIV-incidence sub-Saharan African countries. Positive childhood experiences (PCEs), like strong parent-child relationships, where the child can easily talk with, and feels close to, the parent, may mitigate these effects. We examined how PCEs modify the association between childhood adversity and HIV risk among women aged 19–24 years in Namibia.

Methods: Using nationally representative cross-sectional data from the 2019 Namibia Violence Against Children and Youth Survey and multivariable logistic regression, we estimated moderation effects of 4 individual PCEs (strong father-child relationship, strong mother-child relationship, attending secondary school, and strong caregiver supervision) on the association between having ≥ 3 ACEs and each of 7 sexual HIV risk factors. For significant ≥ 3 ACEs-PCE interaction terms, we repeated the multivariable analyses stratifying among women with and without the PCE. All models accounted for complex survey design and used Bonferroni correction ($P < 0.01$).

Results: Among young women in Namibia, 26% have experienced ≥ 3 ACEs. Strong father-child relationships significantly interacted with having ≥ 3 ACEs for 3 of 7 risk factors. Among women without strong father-child relationships, experiencing ≥ 3 ACEs was positively associated with not knowing a partner's HIV status in the past year (OR: 1.7, 95% CI: 1.7–2.4), infrequently using condoms in the past year (OR: 1.4, 95% CI: 1.0–2.1), and ever having an STI (OR: 2.3, 95% CI: 1.2–4.6). Conversely, among women with strong father-child relationships, experiencing ≥ 3 ACEs was either not significantly, or inversely, associated with the 3 risk factors. No other interactions were significant.

Conclusions: Strong father-child relationships may mitigate the effect of childhood adversity on HIV acquisition risk among young women in Namibia. Continued implementation of multilayered HIV prevention strategies including violence prevention and family strengthening may aid HIV epidemic control globally.

11:55 Animal Exposures Associated with Acute Febrile Illness – Bangladesh, 2019–2020

Authors: Rewa Choudhary, A. Namwase, M.Z. Rahman, M. Rahman, F. Chowdhury, M. Friedman, D. Martin, P. Angra, R. Galloway, P. Das

Background: Acute febrile illness (AFI) is a common presentation in outpatient settings with potentially serious outcomes. Identifying risk factors for infectious AFI etiologies in low-resource settings can minimize morbidity and mortality. We investigated the association between animal exposures and infections presenting as AFI among ambulatory patients in Bangladesh.

Methods: Persons aged ≥ 2 years presenting with fever $\geq 38^\circ\text{C}$ to four public hospitals in Bangladesh from May 2019–March 2020 were enrolled in an AFI sentinel surveillance study. Demographic, livestock/wildlife exposure, and clinical data were collected. Blood and urine specimens were analyzed for selected pathogens. We compared demographic characteristics among those reporting animal exposures using chi-square and estimated the association between animal exposures and laboratory-confirmed infections using univariate logistic regression.

Results: Of 690 AFI patients, 331 (48.0%) reported contact with animals, most commonly with livestock, and of these, 80 (24.2%) tested positive for a pathogen [*Salmonella* Typhi/*Salmonella* Paratyphi, *Rickettsia* spp., *Escherichia coli* urinary tract infection (UTI), dengue viruses, or *Leptospira*]. Patients most commonly reporting animal contacts were aged < 10 years (55.8% versus > 10 years, 44.8%; $P = 0.01$), unemployed or informally employed (58.2% versus other occupations, 44.1%; $P = 0.004$), and living in rural areas (76.3% versus urban, 34.8%; $P < .001$). Those with *E. coli* UTI had higher odds of having an animal birth in their home (odds ratio [OR]: 5.2; 95% CI: 1.6–14.4) and those with *Rickettsia* spp. infections had higher odds of an animal entering their home (OR: 2.5; 95% CI: 1.2–4.9).

Conclusions: Nearly a quarter of AFI patients who reported animal exposures had an identified infectious etiology; some etiologies had higher odds of animal exposures at home. Engaging rural families on limiting animal interaction in the home and educating clinicians to include animal exposure assessment and consider zoonotic etiologies among AFI patients, may reduce AFI burden and morbidity.

12:15 Trends in Insecticide-Treated Net Indices and Effect on Community Malaria Prevalence – Western Kenya, 2015–2020

Authors: Julia M. Janssen, R. Wiegand, B. Seda, K. Onoka, O. Towett, T. Kwambai, S. Kariuki, F. ter Kuile, A. Samuels

Background: Decreases in malaria morbidity and mortality since 2000 have largely been attributed to insecticide-treated nets (ITNs). In western Kenya, where transmission is perennial and high, we modelled the effect of increased ITN ownership, use, and integrity on malaria prevalence to quantify the benefit of maintaining ITN indices at levels achieved after a July 2017 mass ITN distribution campaign.

Methods: We used malaria surveillance data from annual year-round household surveys among residents aged ≥ 1 month. During the first three months following the campaign, 16.3% of participants used damaged (holes larger than an adult fist) ITNs, 72.1% used 'good' ITNs, 0.4% used ITNs with unknown integrity (ITN not inspected), and 11.2% did not use ITNs. These values were set as the maintenance scenario. To estimate the malaria prevalence reduction if the maintenance scenario was sustained, we compared adjusted observed monthly malaria prevalence rates, obtained using logistic regression (controlling for seasonality, rainfall, and ITN indices), to

predicted monthly malaria prevalence rates in the maintenance scenario, obtained using the regression coefficients.

Results: From April 2015 to March 2020, 21,754 residents from 3,086 compounds were interviewed. The observed annualized malaria prevalence ranged from 27%–34%. 'Good', 'damaged' and no ITN use ranged from 42%–64%, 20%–35%, and 14%–24%, respectively. Sustaining the maintenance scenario resulted in a decrease in annual malaria prevalence of 1.5 percentage points (95% CI: 1.1–1.8 percentage points) from April 2015–July 2017 and 0.8 percentage points (95% CI: 0.4–1.2 percentage points) from August 2017–March 2020. Increased 'good' ITN use was associated with minimizing the malaria prevalence difference between the observed and maintenance scenarios.

Conclusions: ITNs are critical for maintaining malaria burden reduction. Sustaining the maintenance scenario did not result in further malaria burden reduction from what has already been achieved primarily through ITN distribution campaigns and education.

12:35 Marburg Hemorrhagic Fever: Investigating West Africa's First Outbreak, and Preparing for the Next — August–September, 2021

Authors: Jason Malenfant, C. Eggers, R. Kallay, S. Corvil, P. Thomas, M. Choi, L. Martel, T. Shoemaker, J. Towner, B. Amman, A. Lebbie, J. Johnny, J. Klena, M. Morales-Betoulle, A. Koroma, C. Bangura, E. Kamanda, A. Osborne, E. Saidu, D. Bangura, J. Musa, I. Bakarr, I. Foday, R. Wadsworth, I. Conteh, J. Montgomery, S. Keita

Background: Marburg virus (MARV), in the *Filoviridae* family, is the causative agent of Marburg virus disease (MVD). The Egyptian rousette bat, *Rousettus aegyptiacus*, is the only known reservoir. There have been 13 reported outbreaks of MVD since 1967, all in eastern, central and southern Africa. On August 3, 2021, the Guinea Ministry of Health reported a fatal case of MVD in Guéckédou, declaring the first-ever outbreak of MVD in West Africa.

Methods: An investigation was launched to identify contacts of the index patient. High-risk contacts were defined as those who had close direct contact with the patient while symptomatic. All contacts were monitored daily for 21 days following their last contact with the confirmed patient. An ecologic evaluation was conducted to assess for the nearby presence of *R. aegyptiacus*

bats. Bats were captured using mist nets and tested for MARV by quantitative reverse transcription polymerase chain reaction (RT-qPCR).

Results: In total, 173 contacts of the index patient were identified, with 14 of these classified as high-risk. A total of 172 contacts completed contact tracing; none developed symptomatic illness. One high-risk contact evaded follow-up by response teams. A cave housing *R. aegyptiacus* bats was found approximately 1.5 kilometers from the index patient's village. Of a total 95 bats captured, only 2 were *R. aegyptiacus*, and both tested negative for MARV.

Conclusions: The mechanism of infection of the index patient for this historic outbreak remains unknown, and it is possible there were other cases that went undetected. A serosurvey in contacts and residents in nearby villages and a landscape ecological assessment may help further elucidate risk factors for acquiring MARV in this region. Further bat-human interactions are likely, increasing the risk for future outbreaks of this disease in Guinea and other countries in West Africa.

CONCURRENT SESSION D2: COVID-19 Diagnostics and Testing

11:30 am–12:55 pm

Introduction: Michael Iademarco

Moderator: Emily Jentes

11:35 Field Evaluation of an At-Home SARS-CoV-2 Rapid Antigen Test — Wisconsin, August 2–October 14, 2021

Authors: Hannah E. Segaloff, M. Lambert, S. Ray, R. Claeys, D. Mumaw, C. Short, J. Ricaldi, J. Villanueva, A. Sterkel

Background: Home SARS-CoV-2 antigen tests offer rapid results without presentation to a testing site, increasing access to SARS-CoV-2 testing, potentially reducing ongoing transmission. However, real-world data evaluating performance of self-collected, at-home tests are limited, including the Ellume COVID-19 home test, which received a Food and Drug Administration Emergency Use Authorization. We sought to understand test performance in real world conditions.

Methods: People seeking SARS-CoV-2 testing at one of five sites during August 2–October 14, were offered a rapid Ellume self-test to use on-site or at home, after a technician collected nasal sample for reverse transcriptase polymerase chain reaction (RT-PCR) test. RT-PCR results were reported to Wisconsin Department of Health Services (WI-DHS). Demographic, symptom, and exposure data were collected during test registration. Ellume results were electronically read and autoreported through the Ellume mobile application to the

Wisconsin Electronic Disease Surveillance System and matched with RT-PCR results. We calculated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of Ellume, compared with RT-PCR results.

Results: In total, 574 persons had paired specimens for RT-PCR and Ellume tests; 85 (14.8%) tested positive by RT-PCR and 117 (20.4%) by Ellume. Sensitivity of Ellume was 67% (95% CI: 56–77), specificity was 88% (95% CI: 84–91), PPV 49% (95% CI: 39–58) and NPV 94% (95% CI: 91–96). Most participants (n = 391, 68.1%) reported ≥ 1 symptom; PPV was low (16%, 95% CI: 5–36; 21 false-positive results) among asymptomatic participants.

Conclusions: Results showing lower sensitivity and specificity than expected were reported to Ellume and WI-DHS, providing WI-DHS with evidence to discourage use of Ellume tests in testing programs. After noticing an increase in false positive results, consistent with our findings, Ellume identified a cause and recalled approximately 2 million tests. These results emphasize the importance of post-market evaluations.

11:55 Abbott BinaxNOW Performance During SARS-CoV-2 B.1.617.2 (Delta) Variant Predominance — Utah, June 2–August 25, 2021

Authors: Jack A. Pfeiffer, M. Friedrichs, W. Lanier, K. McCaffrey, T. Brown, A. Atkinson, K. Babitz, L. Nolen

Background: State laboratory sequencing indicated SARS-CoV-2 B.1.617.2 (Delta) variant became predominant (>50%) in Utah on June 2, 2021. Although reverse transcription–polymerase chain reaction (RT-PCR) remains the gold standard for COVID-19 case detection, rapid (<1 day) antigen tests (e.g., Abbott BinaxNOW) are useful because they allow for timely mitigation strategies. Pre-Delta–period studies demonstrated BinaxNOW sensitivity values ranging from 64.2%–96.5% (symptomatic) and 35.8%–70.2% (asymptomatic), with specificity consistently >90%. We examined BinaxNOW testing performance during Delta predominance in Utah.

Methods: We compared results from persons who received both RT-PCR and BinaxNOW tests on the same day at statewide Utah Department of Health testing sites during June 2–August 25, 2021. BinaxNOW tests were interpreted onsite and RT-PCR samples were transported for laboratory interpretation. BinaxNOW sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated and then stratified by symptom status.

Symptom status was defined as symptomatic or asymptomatic based on self-reported yes or no responses to a COVID-19 symptom inquiry at the time of testing.

Results: Among 11,156 persons who received same-day RT-PCR and BinaxNOW tests, 1,195 (10.7%) tested positive to both, 524 (4.7%) tested BinaxNOW false-negative, 39 (0.4%) tested BinaxNOW false-positive, and 9,398 (84.2%) tested negative to both. Unstratified sample sensitivity was 69.5% (95% CI: 67.3–71.7). Among 10,765 persons tested who responded to the symptom inquiry, 6,961 (64.7%) reported symptoms. BinaxNOW had higher sensitivity among symptomatic persons (75.9% [95% CI: 73.5–78.1]) than among asymptomatic persons (43.0% [95% CI: 37.4–48.7]). BinaxNOW specificity, PPV, and NPV each remained >90.0% throughout all analyses.

Conclusions: Calculated BinaxNOW characteristics were within expected ranges. In Delta-predominant Utah, BinaxNOW remains useful for detecting symptomatic COVID-19 cases but less useful for asymptomatic cases. RT-PCR confirmation should be considered for unexpected BinaxNOW results (e.g., negative in symptomatic persons).

12:15 Testing Outcomes and Student Adherence from an Antigen-based Testing Algorithm in a University Setting, Wisconsin — October–November 2020

Authors: John Paul Bigouette, L. Ford, I. Pray, K. Langolf, J. Kahrs, T. Zochert, J. Tate, D. Gieryn, H. Kirking, R. Westergaard, M. Killerby

Background: For timely detection of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), many institutions of higher education (IHEs) require weekly SARS-CoV-2 antigen testing. Some universities use antigen-based algorithms with confirmatory reverse transcription polymerase chain reaction (RT-PCR) testing for antigen-negative, symptomatic individuals and antigen-positive asymptomatic individuals. We evaluated a public university's SARS-CoV-2 testing algorithm to examine testing outcomes and student adherence.

Methods: Student weekly testing adherence was evaluated during October 5–November 14, 2020 using the university's testing records. Adherence was defined as completing $\geq 80\%$ of required weekly tests. To understand the proportion of individuals who completed recommended RT-PCR confirmatory testing, university medical records were reviewed for all positive antigen tests and a random sample equal to 10% of negative antigen tests during October 19–November 30, 2020. Results were weighted to estimate the proportion of non-COVID-19 exposed individuals requiring only antigen tests

and those completing required RT-PCR confirmatory testing. Using the antigen test's published sensitivity and specificity, we estimated the number of predicted RT-PCR positive specimens and compared this to observed RT-PCR positive specimens.

Results: Overall, 67% (1,166/1,754) of students adhered to weekly testing. An estimated 12% (1,387/11,769) of non-COVID-19 exposed antigen test encounters required confirmatory RT-PCR testing. Only 28% (390/1,387) of testing encounters with recommended confirmatory testing had confirmatory testing performed. The evaluation estimated that the university's testing strategy captured 61% (235/389) of predicted RT-PCR positive specimens, and 80% (123/154) of missed predicted RT-PCR positive specimens occurred in asymptomatic antigen negative individuals.

Conclusions: Serial antigen testing using testing algorithms at IHEs allows for the identification of SARS-CoV-2 spread. Most students voluntarily adhered to weekly testing. The majority of antigen test encounters did not require confirmatory RT-PCR testing, but when required, most individuals did not obtain it. Including strategies for confirmatory testing compliance might improve the program's performance.

Authors: David E. Payne, J. Jacob, S. Chastain-Potts, M. Adjei, B. Taye, C. Williams, L. Short, A. Tran

Background: The emergence of SARS-CoV-2 necessitated the use of rapid, accurate diagnostics. The ID NOW™ COVID-19 assay, a nucleic acid amplification test (NAAT), produces qualitative results in under 15 minutes. The District of Columbia Public Health Laboratory assessed the accuracy of this assay performed at point of care (POC) with a robust quality management system (QMS).

Methods: We placed ID NOW instruments in two POC testing facilities (health clinic and hospital emergency department) and on a Mobile Testing Unit that provides on-site testing for facilities at high risk of COVID-19 spread (e.g., homeless shelters with multiple COVID-19 cases). QMS at each facility included five hours of training and competency assessment, safety risk assessment, and quality control monitoring. Refresher training was provided as needed. Paired swabs (nasal from both nares, nasopharyngeal, or oropharyngeal) from symptomatic and asymptomatic patients (n = 9,518) were used to assess assay performance. One swab was tested using the ID NOW

COVID-19 assay at POC; the other was tested using a NAAT in a high-complexity testing laboratory (Panther Fusion SARS-CoV-2 Assay, Aptima SARS-CoV-2 Assay, or Labcorp COVID-19 RT-PCR Test). Paired test results were analyzed to determine percent agreement and Cohen's kappa (κ).

Results: ID NOW COVID-19 results from POC facilities were similar to laboratory-based NAAT results. Overall percent agreement was 98.3% (range: 96.7%–99.2%). Positive percent agreement was 88.2% (range: 82.2%–90.2%). Negative percent agreement was 99.1% (range: 99.1%–99.6%). κ was 0.88 (range: 0.84–0.88), indicating strong agreement. PPA rose from 90% to 100% following refresher training.

Conclusions: The ID NOW COVID-19 assay at POC performed similarly to laboratory-based NAATs. Rigorous training and competency assessment programs contributed to the performance of the ID NOW COVID-19 assay in these POC settings. Future POC testing initiatives should consider providing a similar emphasis on laboratory quality management.

CONCURRENT SESSION D3: Nutrition, Physical Activity, and Obesity

11:30 am–12:55 pm

Introduction: Celeste Philip

Moderator: Sharyn Parks Brown

11:35 Comfort Eating and the COVID-19 Pandemic: Was Taking Comfort by Eating in Response to Stress and Loneliness Associated with Weight Changes?

Authors: David J. Ederer, S.H. Lee, B. Belay, S. Park

Background: During the COVID-19 pandemic, people experience more stress or loneliness, which can influence eating behaviors. We examined the relationship between stress or loneliness-related comfort eating and weight change during the pandemic among US adults.

Methods: This cross-sectional study used *SummerStyles* survey data collected in June 2021 among 4,085 US adults. The outcome was weight changes since the start of the COVID-19 pandemic with 6 responses: lost ≥ 10 lb, lost 5–9 lb, weight remained the same, gained 5–9 lb, gained ≥ 10 lb, and don't know. The exposure was frequency of comfort eating in response to stress or loneliness during the past year with 3 responses: never/rarely, sometimes, or often/always. Covariates were sociodemographic characteristics, baseline weight status, and census region. We used polytomous multinomial logistic regression to estimate adjusted odds ratios (aOR) and 95% CI for weight changes by comfort eating frequency.

Results: Overall, 51.0% of respondents reported weight changes during the COVID-19 pandemic; 20.5% lost weight, and 30.5% gained weight. Taking comfort by eating in response to stress or loneliness often/always or sometimes was reported by 8.3% and 25.3% of respondents, respectively. Respondents that sometimes or often/always reported taking comfort by eating in response to stress/loneliness had significantly higher odds of any weight increase (aOR ranges: 2.6–13.1) or weight decrease (aOR ranges: 1.9–3.0) than those who never/rarely did. Respondents who reported often/always taking comfort by eating had 13 times higher odds of gaining ≥ 10 lb than those who never/rarely did (aOR = 13.1; 95% CI = 9.2–18.7).

Conclusions: Taking comfort by eating when stressed or lonely was associated with weight changes during the COVID-19 pandemic. Weight changes may lead to additional health complications. Implementing evidence-based strategies to reduce stress or loneliness and support healthy eating during the pandemic may benefit weight management and future well-being.

TUESDAY

11:55 Obesity is Associated with a Higher Risk of Death Among Patients with COVID-19 Aged 20–50 Years — Florida, 2020–2021

Authors: Emily N. Schmitt-Matzen, S. Vasudeo, A. Blackstock, T. Doyle

Background: Past studies have identified obesity and advanced age as risk factors for severe illness and death from COVID-19. We aimed to understand the association between obesity and mortality among adult COVID-19 patients aged ≤50 years in Florida.

Methods: An unmatched case-control study was performed using Florida statewide reportable disease data from laboratory-confirmed COVID-19 cases in unvaccinated persons aged 20–50 years with available body mass index (BMI) data during March 1, 2020–April 30, 2021. Case patients were all eligible persons who died with COVID-19 or an equivalent term listed on the death certificate. To achieve a 1:2 case to control ratio, control subjects were randomly-selected eligible persons who did not die. The association between obesity and death among COVID-19 patients was evaluated using univariate and multivariate logistic regression models; the

multivariable model adjusted for age, sex, race, and ethnicity. Obesity categories included: class I (BMI 30–34.9 kg/m²), class II (BMI 35–39.9 kg/m²), and class III (BMI ≥40 kg/m²).

Results: We enrolled 705 cases and 1,410 controls. In the univariate analysis, compared to normal BMI (18.5–25 kg/m²), obesity was associated with higher odds of death (class I (OR: 2.67; 95% confidence interval (CI): 1.94–3.0), class II (OR: 6.44; 95% CI: 4.51–9.24), and class III (OR: 14.0; 95% CI: 10.1–19.8)). In the adjusted analysis, obesity remained associated with higher risk of death (class I (aOR: 1.64; 95% CI: 1.16–2.34), class II (aOR: 3.88; 95% CI: 2.63–5.77), and class III (aOR: 10.2; 95% CI: 7.09–14.9)).

Conclusions: Among persons aged 20–50 years, increasing BMI was associated with higher odds of mortality from COVID-19 in a dose-response manner. Adults aged 20–50 years with obesity should be advised of increased risk of death from COVID-19 and follow COVID-19 prevention recommendations.

12:15 Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Support and Early Introduction of Infant Cereal, WIC Infant and Toddler Feeding Practices Study-2 — United States, 2013–2014

Authors: Kristin J. Marks, E. Boundy, J. Nakayama, R. Li, H. Hamner

Background: Infants younger than 4 months are not ready for complementary foods (solid or liquid other than breast milk or infant formula), and early introduction may increase their risk of obesity and diabetes. Almost half of U.S. infants participate in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which provides nutrition education and support to low-income families. We describe WIC information that participants receive about introducing complementary foods and assess the association of receiving educational information with early introduction of cereal.

Methods: We used data from a longitudinal study of 1,951 WIC participants who completed phone surveys about their infant's nutrition. We described the prevalence of receiving WIC information and early introduction (<4 months) of cereal by maternal and infant characteristics, assessing differences by chi-square tests. Using multivariate logistic regression, we modeled the association of receiving WIC information on cereal introduction with early introduction of cereal, adjusting for maternal and infant characteristics.

Results: Thirty-six percent of infants had complementary foods early; 48% of these were introduced early to infant cereal. Overall, 40% of women reported not receiving WIC information about the timing of cereal introduction. Women who were Hispanic, first-time mothers, older than 25, had more than a high school education, had received the WIC breastfeeding food package at month 1, and who were not participating in the Supplemental Nutrition Assistance Program were less likely to receive information. There was no association between receiving WIC information and early cereal introduction (adjusted odds ratio: 1.07; 95% CI: 0.77–1.47).

Conclusions: Almost one-sixth of infants were given cereal early. We found that receipt of WIC information about cereal had no association with early introduction of cereal. These findings offer opportunities to improve content, delivery, and completeness of WIC support to prevent early introduction of cereal and promote health.

12:35 Participation and Intention to Use New Places and Changed Spaces for Physical Activity During the COVID-19 Pandemic — United States, 2021

Authors: Bryant J. Webber, J. Omura, K. Irani, G. Whitfield

Background: The COVID-19 pandemic influenced opportunities for outdoor physical activity, but the perceptions and potential effects of these changes are unknown. We assessed the prevalence of new places and built environment changes for physical activity as observed by US adults and their intentions to use them.

Methods: Data were from the June 2021 SummerStyles, a web-based survey of a convenience sample of US adults (N = 4,085; in-panel response rate = 71.2%). Respondents were asked during the past year if they had discovered new places to be physically active, and if changes had been made to streets or outdoor areas to allow additional space for recreating. Those who responded “yes” to either question were asked if they intended to use the respective space for physical activity. We estimated the weighted prevalence of observed new places, changed spaces, and of intended use. We calculated weighted, robust Poisson prevalence ratios to examine differences by demographic and geographic characteristics and self-reported physical activity levels.

Results: Overall, 25.0% of US adults reported discovering new places for physical activity, and 25.3% reported changes to streets and outdoor spaces. Among those who reported discovering new places to be active and changes to streets and outdoor spaces, 91.2% and 61.7% reported intending to use them, respectively. Intention to use new places and changed spaces exceeded 50% among all sociodemographic and geographic subgroups, with mostly non-significant prevalence ratios. Among physically inactive adults, 78.0% intended to use new places to be physically active, and 53.9% intended to use streets and outdoor spaces.

Conclusions: Among surveyed adults, 25% reported discovering new places or built environment changes to support physical activity during the COVID-19 pandemic. Most respondents intended to use these features, including those who were inactive. Sustaining and expanding these supportive environments could help promote physical activity participation.

SESSION E: Donald C. Mackel Memorial Award Finalists

1:25–2:50 pm

Introduction: Leslie Dauphin

Moderator: Tara Henning

1:30 Clarifying Transmission Chains in a Workplace, School, and Fitness Center COVID-19 Cluster – Connecticut, 2020

Authors: Stephen M. Bart, E. Flaherty, T. Alpert, S. Carlson, L. Fasulo, R. Earnest, E. White, N. Dickens, A. Brito, N. Grubaugh, J. Hadler, L. Sosa

Background: People can have multiple SARS-CoV-2 exposures, making delineation of transmission chains difficult. In fall 2020, the Connecticut Department of Public Health (CT DPH) identified 6 COVID-19 cases in employees of a workplace using contact tracing data. One employee (Employee X) also worked in a school and a fitness center; several identified contacts in the school and fitness center were later diagnosed with COVID-19. CT DPH investigated epidemiologic factors and phylogenetic relationships associated with this cluster.

Methods: A case was defined as a positive SARS-CoV-2 nucleic acid amplification or antigen test in a workplace employee, employee primary contact, or employee secondary contact in the week before or 2 weeks after the initial workplace cases. Follow-up interviews investigated exposures and adherence to prevention strategies. SARS-CoV-2 genomes were sequenced from 13 diagnostic specimens; phylogenetic relationships were analyzed.

Results: A total of 16 cases were identified in 6 workplace employees, 2 fitness center attendees, 1 school staff member, 2 students, and 5 household contacts. In the workplace, physical distancing between employees was not possible, and some masked employees interacted with unmasked customers. Employee X taught an indoor fitness class the day before their symptom onset; masks were not worn during physically distanced exercise. Employee X also worked at an elementary school and reported masking and distancing. Employee X's genome was identical or closely related to genomes from contacts in the school (3), fitness center (2), and household (1), supporting direct transmission from Employee X to ≥ 6 persons. Viral genome phylogenetic relationships were not consistent with transmission among the 4 sequenced workplace cases.

Conclusions: SARS-CoV-2 transmission in a school and fitness center was supported by laboratory evidence, but laboratory data disproved suspected transmission among sequenced workplace cases. Both epidemiologic and laboratory data were necessary to accurately delineate SARS-CoV-2 transmission within this cluster.

1:50

Use of Rapid Genomic Sequencing and Vaccine Effectiveness to Assess Vaccine Match Against a New Subgroup of Influenza A(H3N2) Viruses — Michigan, 2021

Authors: Miranda J. Delahoy, L. Mortenson, L. Bauman, J. Marquez, N. Bagdasarian, J. Coyle, K. Sumner, N. Lewis, A. Lauring, B. Flannery, M. Patel, E. Martin

Background: Four human influenza viruses circulate currently, requiring annual vaccine updates to match rapid viral evolution. However, vaccine effectiveness (VE) estimates against contemporary viruses are typically unavailable before annual vaccine strain selection in February. On November 10, 2021, University of Michigan reported a sharp increase in influenza A(H3N2) patients marking one of the first large-scale U.S. influenza outbreaks during SARS-CoV-2 cocirculation. We conducted a field investigation to genetically characterize and estimate effectiveness of the 2021–2022 influenza vaccine against circulating A(H3N2) viruses.

Methods: Symptomatic university clinic patients were tested for influenza by molecular assay. Influenza viruses were genetically characterized using Next Generation Sequencing (NGS). Vaccination status was determined using immunization registries. We estimated VE as $(1 - \text{odds ratio}) \times 100$, adjusted for age and race/ethnicity, using logistic regression comparing odds of vaccination (≥ 14 days before influenza testing) among influenza-positive vs. influenza-negative patients.

Results: During October 6–November 12, 481 of 2,405 patients (20%) tested positive for influenza A(H3N2). One patient was hospitalized. Median age of influenza patients was 19 years (range: 17–29). All 386 sequenced viruses belonged to an emergent A(H3N2) 2a.2 subgroup, which was antigenically distinguishable from the A(H3N2) virus in the 2021–2022 vaccine. Vaccination rates were similar between influenza-positive (27%) and influenza-negative patients (27%). VE against 2a.2 circulating viruses was -4% (95% CI: -31%–18%). Results were provided to state authorities on November 19.

Conclusions: This novel field investigation pairing NGS and VE early in the season, before the annual vaccine strain selection, showed influenza vaccination was ineffective against illness in young adults from an emergent A(H3N2) virus. Results guided communication of prevention and treatment measures, including encouraging symptomatic persons to isolate and promoting influenza antiviral treatment. Rapid sequencing coupled with VE analyses before annual vaccine strain selection decisions might improve influenza control efforts.

2:10

Campylobacteriosis Outbreak Linked to Municipal Water — Nebraska, 2021

Authors: Lauren C. Jansen, R. Birn, S. Koirala, S. Oppegard, B. Loeck, J. Hamik, E. Wyckoff, D. Spindola, A. Roundtree, A. Kahler, J. Yoder, M. Mattioli, B. Buss.

Background: Campylobacteriosis is a diarrheal illness commonly linked to contaminated food or water. On September 14, electronic laboratory reporting identified 8 campylobacteriosis cases in a Nebraska town (population ~330 people). We investigated to find the source and prevent additional illness.

Methods: We distributed 2 questionnaires through social media, email, and door-to-door canvassing, to identify ill people and assess potential exposures. We defined probable or suspect cases as diarrheal illness (≥ 3 stools/24 hours or < 3 stools/24 hours, respectively) among town residents, workers, or visitors, with onset during August 30–October 8, 2021; confirmed cases had *Campylobacter* detected in stool. Isolates underwent whole-genome sequencing (WGS). The Nebraska Department of Environment and Energy (NDEE) performed routine and triggered coliform testing of the municipal water system. Six large-volume (> 100 L) municipal water distribution system samples were collected using dead-end ultrafiltration (DEUF) for *Campylobacter* and microbial source tracking testing at CDC.

Results: From 128 completed questionnaires, 64 (50%) cases were identified (21 confirmed, 38 probable, and 5 suspect). Median age was 56 years (range: 2–90); 33 (52%) were female; with 7 hospitalizations and no deaths. Illnesses occurred in 2 waves, including August 30–September 15 and September 29–October 8. WGS of 12 samples identified 2 distinct *Campylobacter jejuni* subtypes, with 1 subtype per wave. Untreated municipal tap water consumption was associated with illness in each wave, respectively (odds ratio [OR]1: 15.36; 95% CI: 1.8–129.80); (OR2: 7.39; 95% CI: 1.09–175.7). The town began water chlorination or boil orders while investigating system integrity, with no illnesses reported since. During boil orders, NDEE detected coliforms within the distribution system. One DEUF sample yielded nonculturable *Campylobacter* and avian-specific fecal rRNA genomic material.

Conclusions: Investigation findings implicated contaminated untreated municipal water as the outbreak source. Untreated municipal drinking water systems can facilitate large, bacterial waterborne outbreaks.

Authors: Julia K. Petras, A. Kunkel, J. Gettings, M. Firestone, W. Wilson, M. Elrod, J. Gee, Z. Weiner, W. Bower, L. Liu, M. Bye, H. Honza, S. Stonecipher, R. Lynfield, M. Hunter, S. Brennan, J. Pavlick, J. Gabel, C. Drenzek, J. Ritter, S. Zaki, E. Saile, R. Stoddard, C. Gulvik, E. Beshearse, B. Currie, J. Webb, M.E. Negrón, A. Hoffmaster

Background: Between April and July 2021, CDC was notified of 4 melioidosis cases in Georgia, Kansas, Minnesota, and Texas; two were fatal. Melioidosis is caused by the bacterium, *Burkholderia pseudomallei*, which lives in soil and water in tropical and sub-tropical regions. Despite no reported foreign travel history, the 4 patients were infected by the same South Asian strain of *B. pseudomallei* identified by whole genome sequencing. Through a multi-state investigation in partnership with local and state health departments, we aimed to identify the exposure source to prevent additional illness and death.

Methods: We interviewed patients' families using a standardized questionnaire capturing exposure history, including products used, in the 30 days prior to patient's symptom onset. We collected environmental and product samples across the 4 patients' households and surroundings

and tested them for *B. pseudomallei* by PCR and culture. Serology was performed to detect *B. pseudomallei* antibodies for 21 patient family members in Texas and Georgia.

Results: No common exposure was identified across the four cases during interviews. Out of the 221 samples tested, one sample collected from the Georgia patient's household on October 6th from Better Homes & Gardens' "Lavender & Chamomile Essential Oil Infused Aromatherapy Room Spray with Gemstones" was PCR and culture positive for *B. pseudomallei*, and genetically matched the strain that infected the four patients. The Consumer Product Safety Commission recalled the product line which was imported from India and sold by Walmart nationwide to over 2,800 households. Serology identified 9 of the 21 family members with antibody titers of $\geq 1:40$, indicating potential exposure to the same source.

Conclusions: Identification and recall of these products likely prevented additional melioidosis cases and deaths. This is the first reported multi-state melioidosis outbreak in the United States and confirms imported products from endemic countries pose a risk to public health.

SESSION F1: Environmental and Occupational Health

3:20–5:05 pm

Introduction: Patrick Breysse

Moderator: Maria Mirabelli

3:25 Assessing the Human Health Impact of an Industrial Facility Fire — Winnebago County, Illinois; June–July 2021

Authors: Jasmine Y. Nakayama, K. Surasi, M. Johnson, S. Martell, S. Patrick, L. Owen, K. Horton, M. Orr

Background: In June 2021, a chemical manufacturing facility in Winnebago County, Illinois (population: 285,350) caught fire, releasing smoke, dust, and debris for four days. In response, the Winnebago County Health Department (WCHD), Illinois Department of Public Health, and Agency for Toxic Substances and Disease Registry (ATSDR) collaborated to use novel methods, adapting COVID-19 pandemic resources and existing surveys to investigate the fire's effect on human health.

Methods: We adapted and combined two ATSDR interviewer-administered health surveys using an electronic system that allowed people to self-administer. During July 1–15, the survey was announced through news outlets, social media, and the WCHD website. WCHD also emailed the survey to 40,217 persons previously registered in the electronic system for the COVID-19 vaccine from 11 selected zip codes (five identified by syndromic surveillance plus six nearby, population: 240,043). We calculated frequencies of symptoms and

hospitalizations. We combined data from the 2019 American Community Survey with geospatial analyses to visualize the distribution of response rates and respondents' symptom status.

Results: The investigation collected 2,030 survey responses in 2 weeks, with 916 respondents reporting any new or worse symptom, typically related to ears, nose, and throat (638); the nervous system (478); and eyes (383). Four respondents reported hospitalization. A total of 1,807 respondents accessed the survey through the email. The census tract where the facility was located had the highest survey response rate (37.9 surveys per 1,000 residents) and the highest rate of respondents reporting any symptom (63.9% of 241).

Conclusions: This response demonstrates the usefulness of efforts developed during the COVID-19 pandemic to serve other public health needs. The methodology permitted efficient, focused surveying of health effects within an exposed population after a chemical incident. Future investigations might benefit from using this approach for directing public health resources to effectively address immediate community needs.

3:45

An Evaluation of the National Environmental Public Health Tracking Network as a Surveillance Tool for Radon Testing

Authors: Alyssa N. Troeschel, M. Monti, A. Winquist, F. Yip

Background: In the United States (U.S.), radon causes approximately 21,000 lung cancer deaths annually. The National Environmental Public Health Tracking Network (EPHTN) provides US county-level estimates for several radon measures (e.g., number of buildings tested, median radon level in tested buildings) that can be used to identify populations at risk of elevated exposure to indoor radon. This evaluation assessed the usefulness and stability of EPHTN's radon data.

Methods: We used data from 15 EPHTN-funded states and 6 national radon laboratories that collect and submit radon data to EPHTN. To protect confidentiality, all data are deidentified and aggregated to the county-level before being displayed publicly. To evaluate stability of the surveillance system, we examined data submission frequency and interviewed EPHTN staff about operation processes. To evaluate usefulness, we interviewed informants from eight funded states about their use of the data.

Results: Initial data submissions from states occurred during 2010–2016, covering varying ranges of prior years; 13 of 15 states submitted annual updates through 2017. In 2019, radon laboratories submitted data covering 2005–2017, including 49 states; additional submissions were delayed by process changes and inadequate resources for de-identification. Although none of the interviewed informants reported using EPHTN radon data, many reported using state-owned data to target radon-related outreach programs (n = 7), evaluate the effectiveness of those programs (n = 4), and support radon-related legislation (n = 5). One common reason for not using the EPHTN platform was the need for finer geographic resolution.

Conclusions: Additional resources would be helpful to support the stability of the more inclusive lab data. Displaying radon data with finer geographic resolution, while preserving confidentiality, could enhance usability of the data and assist public health professionals in tailoring public health outreach and supporting legislation to reduce radon exposure. This may be especially important for users without access to the state-owned data.

4:05

Occupational and Workplace Factors Associated with SARS-CoV-2 Infection Based on Serologic Status Among Blood Donors — July 2021–November 2021

Authors: Melisa M. Shah, B.R. Spencer, L.R. Feldstein, J.M. Haynes, T.J. Benoit, D.E. Krysztof, M.R. Groenewold, S.L. Stramer, J.M. Jones

Background: Limited data exist on the risk for SARS-CoV-2 infection by occupation. Understanding occupational risk factors for SARS-CoV-2 infection is paramount for informing vaccine allocation, boosters, and workplace safety measures. We aimed to determine which occupations are associated with prior SARS-CoV-2 infection among blood donors in the United States.

Methods: During July–November 2021, blood donors were tested for evidence of prior SARS-CoV-2 infection (defined as positive anti-Nucleocapsid (N) antibodies) at the time of donation. Donors received an electronic survey 2–6 weeks after donation on employment status, vaccination, occupation, and workplace safety. Donors employed for ≥ 30 days since March 2020 with a codifiable occupation were included in an unmatched case-control analysis. Donors with anti-N-positive or anti-N-negative sera were considered cases or controls, respectively. Self-reported occupations were grouped into 23 categories from the National Center for Health Statistics (NCHS). The association of occupation with anti-N positivity

was estimated by multivariable logistic regression; covariates included age, sex, geographic location, vaccine status, and amount of telework.

Results: Among 36,586 blood donors, there were 3,145 (8.6%) cases and 33,441 (91.4%) controls. In adjusted analyses, healthcare occupations (adjusted odds ratio [aOR] 1.5, 95% CI: 1.2–1.8), protective service occupations (aOR: 1.4, 95% CI: 1.0–1.8), and community and social service occupations (aOR: 1.4, 95% CI: 1.1–1.8) were more likely to have prior SARS-CoV-2 infection compared with donors of any occupation reporting exclusive telework. Exclusive telework was highest among computer and mathematical occupations (55.3%). Absence of COVID-19 vaccination was associated with case status (aOR: 2.76, 95% CI: 2.5–3.0).

Conclusions: Among blood donors, those in healthcare, protective service, and social service occupations, which often require direct human contact, were at highest risk for prior SARS-CoV-2 infection compared to exclusive teleworkers. Employers in these occupations should reemphasize workplace COVID-19 prevention measures including encouraging vaccination.

4:25

Mitigating an Unknown Threat: Acute Nonviral Hepatitis Linked to a Brand of Alkaline Bottled Water — Nevada and California, 2020

Authors: Jeanne Ruff, D. Raman, L. DiPrete, C. Sylvis, Y. Zhang, D. Noguee, M. McClure, K. Allen, B. Shen, C. Callaway, A. Winquist

Background: In November 2020, public health authorities in Nevada were notified of 5 children hospitalized with severe, unexplained nonviral hepatitis. All had consumed the same brand of alkaline bottled water (Brand A). We sought to identify the outbreak cause and extent and mitigate the hazard.

Methods: Probable and suspected cases had unexplained liver function test abnormalities above specified thresholds on or after August 1, 2020, after consumption of Brand A water during the preceding 30 days. Probable cases also had negative hepatitis A, B, and C tests and hepatic imaging with unexplanatory results. A laboratory confirmed case definition was not established because cause of illness was unknown. Cases were identified through self- and clinician report to local health jurisdictions. We surveyed patients and household members and used logistic regression to determine whether average daily volume of Brand A water consumed

by bodyweight was associated with hospitalization. Bootstrap resampling was used to account for household clustering. Production facilities were inspected and Brand A samples from facilities and patients were tested.

Results: Twenty-one probable and 4 suspect cases were identified in Nevada and California. All patients with probable cases were hospitalized; 18 (86%) required intensive care. For every 1 mL/kg/day increase in Brand A consumption, the odds of being hospitalized increased almost 11% (OR: 1.109, bootstrap 95% CI: 1.071–1.197). Medical record review indicated a possible toxic etiology, but a substance likely to have caused illnesses was not identified through laboratory testing of Brand A water samples. However, inadequate sanitation, labeling, and quality control practices were discovered at production facilities. The firm recalled all products and ceased operations after a consent decree.

Conclusions: A combined epidemiology, environmental, and regulatory response allowed mitigation of this unusual health threat.

4:45

Childhood Blood Lead Testing Before the COVID-19 Pandemic, During Peak COVID Surge, and During Recent Months — Chicago, 2020–2021

Authors: Hillary Spencer, E. Jorgensen, J. Seo, C. Robinson

Background: Early childhood lead exposure can cause serious harm, including brain damage. Because of aged housing stock, high rates of elevated blood lead levels (BLLs) are reported in Chicago children. BLL screening is an essential activity of pediatric primary care with required reporting to the state. Disruption in primary care was reported during the COVID-19 pandemic onset. We sought to determine effects of the COVID-19 pandemic regarding BLL testing among pediatric residents of Chicago.

Methods: We quantified the number of BLL tests reported to the state's Healthy Homes and Lead Poisoning Surveillance System for Chicago residents aged 11–48 months. We compared total tests during March–September 2021 (i.e., recent) with the same calendar months in 2020 (i.e., during) and with the mean in the same months in 2017–2019 (i.e., before) and calculated percentage change during these periods citywide. We evaluated geographic variation by comparing

percentage change in BLL tests performed across Chicago's 77 community areas.

Results: Mean number of tests reported for the before period was 36,307, compared with a total of 24,387 tests for the during period (–33%) and 28,622 tests for the recent period (–21%). Across community areas, percent change in BLL testing from before to during ranged from +37% to –65% (median: –35%) and from before to recent ranged from +10% to –49% (median: –19%).

Conclusions: Pediatric BLL testing has decreased during the pandemic. Although testing volume has increased in recent months, it remains lower than pre-pandemic. The resulting decrease means children in Chicago are at increased risk for undetected elevated BLLs. Geographic variations can guide prioritization for public health intervention and outreach to ensure all children, especially those at greatest risk, are tested for elevated BLLs.

SESSION F2: Migrant, Refugee, and Traveler Health

3:20–5:05 pm

Introduction: Clive Brown

Moderator: Virginia Bowen

3:25 Investigation of Two Travel-Associated Cases of Monkeypox — Texas and Maryland, 2021

Authors: Faisal S. Minhaj, J. Schulte, M. Kreuze, W. Davidson, C.M. Hughes, T. Chen, K. Delea, S. Wada, D. Blythe, B. Sunshine, F. Whitehill, N. Baird, C.N. Morgan, M. Markarian, D. Crum, D. Kuhar, B. Christensen, Y. Li, K. Wilkins, C. Gigante, D. Lowe, L. Delaney, M. De Perio, P.S. Satheshkumar, N. Ravi-Caldwell, P. Yu, Y. Yu, A.K. Rao, A.M. McCollum

Background: Monkeypox is a rare, sometimes life-threatening zoonotic orthopoxvirus infection found in west and central Africa. Since its re-emergence in Nigeria in 2017, there have been six travel-associated infections in Europe and Asia. In 2021, two independent cases of monkeypox were diagnosed in Texas and Maryland. We responded to identify exposed persons, provide clinical recommendations, and prevent secondary cases.

Methods: Patients were interviewed to determine possible sources of infection, clinical timeline, and exposed persons. Health departments monitored exposed persons for 21 days and counseled them about post-exposure vaccination. Clinicians and the public were alerted through messaging. We considered nationally stockpiled therapeutics for treatment and provided recommendations about disinfection of contaminated environments. Duration of isolation was informed by polymerase chain reaction (PCR) assays. Whole genome sequencing (WGS) was performed, and the results compared to previous strains.

Results: Neither patient reported direct contact with ill persons or animals. Patients developed symptoms 9 and 2 days before departing Nigeria. Health departments in 24 jurisdictions monitored 282 contacts including airline passengers (176; 62.4%), healthcare personnel (87; 30.9%), and ride-share drivers (9; 3.2%). No persons elected to receive vaccination because of perceived safety concerns. For the Texas case, a Health Alert Network notification was sent to ensure clinician awareness. No additional cases were identified. The Texas patient received a stockpiled antiviral—tecovirimat—because of severe illness. Cleaning protocols used by airlines were determined acceptable for inactivating orthopoxviruses; residential decontamination included household disinfection and discarding soiled furniture. Specimens from both patients were PCR-positive for over 23 days which delayed hospital discharge for one patient. WGS revealed two different genomes, both consistent with strains circulating in Nigeria.

Conclusions: Investigating each case required substantial multidisciplinary public health resources. Because of increasing travel-associated cases from Nigeria and unknown sources of infection, health departments may consider developing monkeypox response protocols.

3:45

Farmworker Mobility and COVID-19 Vaccination Strategies — Yuma County, Arizona, 2021

Authors: Katherine A. Franc, A. Phippard, P. Ruedas, S. Pinto, K. Mehta, S. Montiel, S. Contreras, H. Katz, E. McIntyre, B. Lopez, M. Kreutzberg-Martinez, D. Steiner, D. Gomez, R. Merrill

Background: Migrant and Seasonal Farmworkers (MSFW) are essential workers who experience disproportionate burden of COVID-19 due to living and working conditions. We characterized farmworker mobility in and around Yuma County to identify opportunities to improve MSFW access to COVID-19 vaccination.

Methods: Qualitative and geospatial data was collected through a series of virtual or in person focus group discussions (FGD), key informant interviews (KII), or intercept interviews (II) with participatory mapping. Participants included farmworkers or their family members (N = 97) and persons from other diverse partner groups (N = 37). Participants were sampled by mixed methods including purposive and referential sampling and grouped by type for interviews. Qualitative and geospatial analyses were used to identify common themes and mobility patterns.

Results: A total of 134 persons participated in 16 FGD, 5 KII, and 5 II from February 26–April 2, 2021. Common themes emerged about how MSFW have little or no access to COVID-19 vaccination unless offered at their workplaces or at times and locations convenient for them. This is especially true for MSFW with H2-A visas since they are more likely to be working and living in rural locations and depend on their employers to provide transportation and housing. Geospatial analyses identified three geographic areas in Yuma County where MSFW reported to live and work that did not have a COVID-19 vaccine clinic within walking distance. For MSFW who cross the United States-Mexico border daily to work in Yuma County, participants described how their demanding work schedules, long commute times, and home commitments make it challenging to access the vaccine through opportunities outside of their workplaces.

Conclusions: Coordination between local health departments, employers, community-based organizations, and other partners to offer vaccination services at worksites or other convenient locations where MSFW congregate can help improve access to COVID-19 vaccines for this population.

4:05

Multistate Nontyphoidal *Salmonella* and Shiga Toxin-Producing *Escherichia coli* Outbreak Investigations Linked to International Travel — United States, 2017–2020

Authors: Caroline A. Habrun, K. Benedict, K. Nemechek, L. Bottichio, M. Robyn, L. Francois Watkins, M. Birhane, B. Tolar, M.N. Schroeder, M. Nichols

Background/Objective: Enteric bacterial infections are common among people who travel internationally, yet barriers exist to investigating and preventing travel-associated illness. We sought to quantify and describe travel-associated nontyphoidal *Salmonella* and Shiga toxin-producing *E. coli* (STEC) infections and resulting multistate illness investigations.

Methods: We evaluated multistate outbreak investigations recorded by CDC in the Outbreak Management System (OMS) and PulseNet, the national molecular subtyping network for foodborne disease surveillance, during 2017–2020, and extracted patient information from the System for Enteric Disease Response, Investigation, and Coordination. Travel-associated outbreak investigations were defined as two or more enteric illnesses caused by genetically related pathogens occurring in travelers residing in multiple states with $\geq 50\%$ of people with available information reporting international travel during their incubation period, or the event recorded in OMS as linked to international travel. Resistance data were obtained

from the National Antimicrobial Resistance Monitoring System; we defined an isolate as multidrug resistant (MDR) if resistant to ≥ 3 antimicrobial classes.

Results: We identified 29 *Salmonella* and 11 STEC multistate outbreak investigations linked to international travel, involving 1,054 illnesses, 8 hospitalizations, and 4 deaths in residents of 49 states and the District of Columbia. Of those with information, 433/621 (70%) reported international travel—317/433 (73%) to Mexico and 80/433 (18%) to the Dominican Republic; travel occurred year-round. Multidrug resistance was detected in $\geq 10\%$ of the isolates in 4/28 (14%) *Salmonella* and 7/11 (64%) STEC outbreak investigations. Six of eight (75%) hospitalized people and 4/4 (100%) of people who died had MDR isolates.

Conclusions: Travel-associated illnesses occurred year-round, among patients in most states, with the highest proportion reporting travel to Mexico. Investigating illnesses among returned travelers could provide the opportunity to prevent illness and spread of MDR organisms domestically as well as in the countries of travel through international data sharing and collaboration.

4:25

Refugee Outreach Unit Formation for the COVID-19 Response — Maricopa County, Arizona, January 2020–November 2021

Authors: Ariella P. Dale, K. Schlum, J. Zan, A. Bideri, A. Mohammed, M.S. Gallaway, K. Komatsu, J. Davis, E. Metas, C. Eakin, S.E. Scott

Background: In Arizona, most refugees resettle in Maricopa or Pima Counties; 1,652 refugees arrived in 2019. Collaborating with the State Refugee Health Coordinator, Maricopa County Department of Public Health (MCDPH) and Arizona Department of Health Services (ADHS) recognized the need to quantify the COVID-19 burden within refugee communities. We sought to begin delivery of culturally and linguistically appropriate public health outreach, case investigation (CI), and contact tracing (CT) to refugee communities. To support this effort, MCDPH created Clinical Health Navigator (CHN) positions to outreach to Maricopa County refugee communities.

Methods: To identify COVID-19 cases among refugees, ADHS matched confirmed and probable COVID-19 cases during January–July 2020 to arrival data from the Electronic Disease Notification System. We analyzed Maricopa County refugee COVID-19 case data by birth country to guide hiring of CHNs, assessed CI completion, and tracked outreach events.

Results: Of 118,497 reported COVID-19 cases in Maricopa County during January–July 2020, 649 (0.5%) were among refugees. Top reported birth countries among SARS-CoV-2 positive refugees included Iraq (146 cases; 22%), Democratic Republic of the Congo (116 cases; 18%), and Myanmar (68 cases; 10%). No other country accounted for >6% of cases. Four CHNs, all previously resettled refugees, were hired. Collectively, CHNs speak 9 languages, including those from the 3 predominant countries, and began CI/CT in December 2020. During December 2020–November 12, 2021, CHNs completed 440 interviews among 825 refugees (53%) with a positive SARS-CoV-2 test, hosted >30 educational sessions, increased access to free isolation housing and testing, provided personal protective resources, and hosted 38 COVID-19 vaccination events.

Conclusions: Data from multiple governmental agencies can be leveraged to improve public health outreach and provide interventions to specific populations. Hiring resettled persons for increased public health outreach through education, testing, vaccination, and CI likely improved MCDPH connections with the refugee communities.

4:45

Falsification of Travel-Required COVID-19 Laboratory Reports — United States Virgin Islands, March–April 2021

Authors: Valerie V. Mac, M. Taylor, I. Guendel, W. Harris, J. Roth, K. Bisgard, E. Ellis

Background: On January 18, 2021, an incoming traveler submitted a COVID-19 test result to the US Virgin Islands (USVI) Travel Portal that contained indications of alterations from its original, laboratory-issued report. Verification by USVI Department of Health (VIDoH) with the laboratory found the submitted report was altered from a positive to a negative result, prompting an audit. We describe the estimated prevalence of falsified laboratory report submissions to USVI and resulting actions.

Methods: During March 29–April 25, 2021 travel portal submissions data regarding travel dates, demographics, and laboratory reports were reviewed; suspected falsified laboratory reports, based on indications of pdf-editing software use, visual observation of creative formatting/text, or misaligned text were flagged for review. We queried reporting laboratories to find reports with incorrect personal or sample identifiers, collection dates, or test results.

Results: Of 85,597 laboratory reports, 182 (0.21%) were flagged for review for falsification concerns; 30 (16.5%) reports were confirmed as valid, 118 (64.8%) reports remained unverified because of non-response from the issuing laboratory, and 34 (18.7%) reports were verified as having falsified personal or sample identifiers, collection dates, or test results. Among 34 travelers who submitted falsified laboratory reports, the mean age was 34 years (range 6–73 years); including 5 minors; 19 (55.9%) were female; for 7 (20.6%) sex was not reported. The submission date for laboratory reports was 0 days (<24 hours) to 4 days prior to arrival (median = 1 day, IQR: 1 day).

Conclusions: Public health jurisdictions that mandate COVID-19 tests should be aware of the possibility of falsified laboratory reports. A standard method for reporting required pre-travel laboratory results directly from the issuing laboratory to the USVI Travel Portal would avoid the possibility of falsification by the traveler while alleviating the need for epidemiology staff and resources to verify individual traveler results.

SESSION F3: Benefits of COVID-19 Vaccination

3:20–5:05 pm

Introduction: Amanda Cohn

Moderator: Larry Cohen

3:25 Effectiveness of COVID-19 Vaccines Against Symptomatic Infection by Time Since Vaccination Before and During Delta Variant Predominance — United States, March 13, 2021–October 17, 2021

Authors: Amadea K. Britton, K. Fleming-Dutra, Z. Smith, N. Shang, T. Dorji, G. Derado, E. Accorsi, U. Ajani, J. Miller, S. Schrag, J. Verani

Background: Monitoring effectiveness of COVID-19 vaccines both over time and against emerging variants is important for informing COVID-19 policies and control measures. We estimated vaccine effectiveness (VE) of US-authorized COVID-19 vaccines against symptomatic infection by time since vaccination before and during Delta variant predominance.

Methods: We used data from the national US-pharmacy-based *Increasing Community Access to Testing* (ICATT) platform to evaluate VE of full vaccination against symptomatic infection. Using a test-negative case-control design and spline-based multivariable logistic regression, we estimated VE by day since vaccination during pre-Delta (March 13–May 29, 2021) and Delta (July 18–October 17, 2021) periods.

Results: We included 1,813,375 tests from adults ages ≥ 20 years and 204,335 from adolescents ages 12–19 years. Among adults, Pfizer-BioNTech initial VE (mean daily VE during days 14–60 since vaccination) was higher pre-Delta (90.2%; 95% confidence interval [CI]: 89.3, 91.2) than during Delta (82.4%; 95% CI: 81.7, 83.1) and declined during both periods (pre-Delta: 3.0% [95% CI: 1.6, 4.4] per month; Delta: 3.2% [95% CI: 2.7, 3.6] per month). Moderna initial VE was 95.4% (95% CI: 94.7, 96.1) pre-Delta, 88.8% (95% CI: 88.0, 89.5) during Delta, and similarly declined (pre-Delta: 2.0% [95% CI: 0.9, 3.0] per month; Delta: 3.6% [95% CI: 3.1, 4.2] per month). Janssen initial VE was 55.1% (95% CI: 50.9, 59.4) pre-Delta and 33.9% (95% CI: 29.7, 38.0) during Delta, after which VE increased then stabilized. Among adolescents, Pfizer-BioNTech initial VE during Delta was 93.9% (95% CI: 93.1, 94.8) in 12–15-year-olds and 89.7% (95% CI: 88.5, 90.9) in 16–19-year-olds, declining 3.1% (95% CI: 1.8, 4.4) and 4.6% (95% CI: 2.6, 6.5) per month, respectively.

Conclusions: mRNA COVID-19 VE against symptomatic infection waned steadily and was impacted more by time since vaccination than by Delta predominance. Janssen VE was lower than mRNA VE but did not wane. Booster doses may be needed to optimize protection.

3:45

Differences in Anti-SARS-CoV-2 Antibody Levels Among University Students Vaccinated with U.S. Domestic and International COVID-19 Vaccinations — Madison, Wisconsin, September 2021

Authors: Peter M. DeJonge, A. Lambrou, H. Segaloff, A. Bateman, A. Sterkel, P. Kelly, J. Baggott, C. Griggs, R. Desamu-Thorpe, T. Somers, G. Abedi, C. Hsu, L. Tison, D. Turner-Harper, A. Matanock, O. Almendares, M. Whaley, A. Chakrabarti, R. Westergaard, J.E. Tate, H. Kirking

Background: United States universities offer a unique opportunity for COVID-19 serology investigations because they often host a sizeable proportion of international students who received COVID-19 vaccinations outside of the United States. We conducted a cross-sectional investigation at a large, Wisconsin university to determine associations between anti-SARS-CoV-2 antibody levels, vaccine types received, and time since vaccination.

Methods: During September 2021, we recruited dormitory residents by email to participate in an opt-in serology project. We tested collected sera using the Abbott ARCHITECT platform for both anti-spike and anti-nucleocapsid immunoglobulin G (IgG) antibodies. We linked serology results to participant-reported sociodemographic information and the university's COVID-19 vaccination database. Wilcoxon rank-sum tests and multivariable linear regression were used for statistical comparisons.

Results: Overall, 224 students participated (125 [55.8%] female; median age: 18.8 years). The most frequent vaccination regimens were mRNA-based Pfizer and Moderna (69 [30.4%] and 52 [23.2%], respectively), followed by inactivated virus vaccines Sinovac and Sinopharm (41 [18.3%] and 31 [13.8%], respectively). Fewer students were unvaccinated (12, 5.3%) or vaccinated with vector-based vaccines (19, 8.4%), including Johnson & Johnson, Covishield, and AstraZeneca. Compared to inactivated virus vaccines, mRNA vaccines were associated with higher anti-spike IgG levels (median: 5774 vs. 453 arbitrary units/mL; $P < .001$) and lower anti-nucleocapsid IgG levels (median: .05 vs. 1.4 index value; $P < .001$). For both mRNA and inactivated virus vaccines, anti-spike IgG levels were negatively associated with time since vaccination; a statistical test for interaction determined that the rate of anti-spike IgG waning was significantly different between vaccine types ($P < .001$).

Conclusions: Distinct COVID-19 vaccination regimens were associated with differential antibody responses. These findings highlight the need to better interpret anti-spike and anti-nucleocapsid levels in the context of clinical protection and vaccine effectiveness. Thus, further testing with a validated quantitative assay has been initiated.

4:05

Primary and Secondary Attack Rates by Vaccination Status After a SARS-CoV-2 Delta Variant Outbreak at a Youth Summer Camp — Texas, June 2021

Authors: Julia M. Baker, M.M. Shah, M. O'Hegarty, M. Pomeroy, P. Keiser, P. Ren, S.C. Weaver, S. Maknojia, J.E. Tate, H.L. Kirking

Background: During June 23–27, 2021, a SARS-CoV-2 Delta variant outbreak occurred at an overnight camp attended by 364 youths aged <18 years and 87 adults. Our investigation assessed SARS-CoV-2 transmission across two cohorts—camp attendees and household members—and estimated the risk of COVID-19 among vaccinated and unvaccinated individuals.

Methods: Vaccination history and COVID-19 test results through July 11, 2021 (reported passively) were compiled for all camp attendees. A subset of 92 attendees volunteered to be interviewed about SARS-CoV-2 exposure, vaccination (date, type), COVID-19 testing details (date, viral test type), and symptoms. To quantify the risk of onward transmission, household members of interviewed camp attendees with laboratory-confirmed or probable COVID-19 (≥ 1 COVID-19 symptom within 2 weeks of camp) were also interviewed. Attack rates (ARs) were calculated for camp attendees and household members by dividing the number of confirmed

and probable cases by the total number of individuals in the stratum. A convenience sample of 13 positive diagnostic samples from camp attendees were sequenced for variants.

Results: The AR was 41% among all camp attendees and 42% among youths. ARs were lower among vaccinated (≥ 2 weeks after completion of primary series) (8%) than among unvaccinated youths (48%; $P < .001$). The Delta variant was identified in all specimens sequenced. The secondary household AR was 51% among 115 household contacts of 55 index patients. ARs were 33% and 67% for vaccinated and unvaccinated household members, respectively. The secondary AR was 30% (3/10) among household members exposed to vaccinated index patients and 58% (59/102) among those exposed to unvaccinated index patients.

Conclusions: The combination of ARs across two transmission cohorts illustrates the strong association between vaccination and COVID-19 among individuals and their household members. These data suggest that vaccinating youths can help decrease the spread of COVID-19 in congregate settings and minimize secondary household transmission.

4:25

The Effect of Student COVID-19 Vaccination Coverage on Case Rates in New Jersey Middle and High Schools — Fall 2021

Authors: Reed Magleby, B. Katic, B. Carothers, K. Cervantes, E. Lifshitz, D. Thomas, C. Tan

Background: Student vaccination is an important strategy to reduce the spread of COVID-19 in schools. However, it is unclear to what extent vaccinations among students reduce school COVID-19 cases. We analyzed the effect of vaccination coverage on COVID-19 cases reported among students in New Jersey middle and high schools during Fall, 2021.

Methods: Public and private K–12 schools in New Jersey report known COVID-19 cases among students, student censuses, and numbers of fully vaccinated (as defined by CDC) students to the New Jersey Department of Health (NJDOH) weekly. We analyzed COVID-19 cases and vaccination coverage among students reported by middle and high schools during August 30–November 14, 2021. We calculated vaccination coverage as all fully vaccinated students divided by student census for each school. We then compared mean COVID-19 student cases (calculated as cases per 1000 students reported

during the reporting period) stratifying by vaccination coverage.

Results: Overall, 319 middle and high schools reported vaccination and case data to NJDOH during the investigation period; 204 (64%) had vaccination coverage <40%, 69 (22%) had vaccination coverage 40–59%, 30 (9%) had vaccination coverage 60–79%, and 16 (5%) had vaccination coverage ≥80%. For the entire reporting period, the mean case rate per 1000 students was 14.9 (95% CI: 13.1–16.7) overall and was 16.4 (95% CI: 13.9–19.0) for schools with <40% vaccination coverage, 15.3 (95% CI: 12.4–18.2) for schools with 40–59% vaccination coverage, 8.7 (95% CI: 5.8–11.7) for schools with 60–79% vaccination coverage, and 7.4 (95% CI: 3.9–10.9) for schools with ≥80% vaccination coverage.

Conclusions: Schools with higher COVID-19 vaccination coverage reported lower case rates among students during the reporting period. Jurisdictions should prioritize and encourage student vaccination to prevent COVID-19 cases in schools.

4:45

Characterization of COVID-19-Associated Deaths During the SARS-CoV-2 Delta Variant Surge Among Adults Aged 20–49 — Kentucky, July 1–August 13, 2021

Authors: Alyson M. Cavanaugh, K. Spicer, L. Raparti, C. Holladay, M. Bhurgri, A. Herrington, K. Winter, D. Thoroughman

Background: Although risk of severe COVID-19 increases with age, COVID-19-associated deaths are increasingly reported in younger adult populations. This change could be caused by increased transmission or virulence of the SARS-CoV-2 Delta variant, or lower vaccine uptake among younger adults. To better understand fatal infections in younger adults, we reviewed demographics and underlying health conditions of all COVID-19-associated deaths among persons aged 20–49-years occurring during the Delta variant surge in Kentucky.

Methods: All COVID-19-associated deaths reported by November 15 among Kentucky residents aged 20–49 years with a positive SARS-CoV-2 antigen or nucleic acid test from July 1–August 13, 2021 were included. Demographics and health information were obtained from available case investigation records, hospitalization records, the Kentucky Health Information Exchange, the Kentucky Immunization Registry, and death certificates. Vaccination was defined as full (primary series completed ≥14 days before positive test), partial (received ≥1 dose but did not complete series ≥14 days before positive test) or unvaccinated (no vaccine).

Results: Seventy-six COVID-19-associated deaths were included in analyses, with 73 occurring among unvaccinated persons including 3 unvaccinated healthcare personnel. Death rates were 7.27, 0.90, and 0.33 per 100,000 unvaccinated, partially, and fully vaccinated persons, respectively. Two fully vaccinated and one partially vaccinated decedent had immunocompromised health status. Prevalent underlying conditions included obesity (61/71 with obesity data, 85.9%), hypertension (44/76, 60.5%), diabetes (30/76, 39.5%), and chronic lung disease (15/76, 19.7%).

Conclusions: COVID-19-associated deaths among Kentucky residents aged 20–49 years occurring early in the Delta variant surge appear to have been largely vaccine-preventable. The overwhelming majority of decedents were unvaccinated, and all three partially or fully vaccinated decedents had immunocompromised health conditions that, under current recommendations, would have made them eligible to receive an additional primary mRNA COVID-19 vaccine dose. Increasing full vaccination is critical to reducing risk of death from COVID-19.

WEDNESDAY

CONCURRENT SESSION G1: One Health: Pandemic, Prevention, and Plague

11:30 am–12:55 pm

Introduction: Casey Barton Behravesh

Moderator: Jennifer Wright

11:35 SARS-CoV-2 Outbreak Involving Malayan Tigers and Humans – Tennessee, 2020

Authors: Heather N. Grome, B. Meyer, E. Read, M. Buchanan, A. Cushing, K. Levinson, L. Thomas, Z. Perry, A. Uehara, Y. Tao, K. Queen, S. Tong, R. Ghai, M. Fill, T. Jones, W. Schaffner, J. Dunn

Background: In October 2020, all 3 Malayan tigers at a Tennessee zoo were diagnosed with symptomatic Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection. Human-to-feline and airborne transmission among cats of SARS-CoV-2 had been described, though risk of feline-to-human transmission at the zoo was unknown. We investigated to determine source and prevent further transmission to employees and animals.

Methods: An environmental assessment and infection prevention practices at the zoo were reviewed. We interviewed employees who interacted with the tigers 2 weeks before animal symptom onset (September 28) until date of investigation (October 29). Interviewed employees had SARS-CoV-2 RT-PCR testing on October 30. Tigers and employees had specimens sent to CDC for genomic sequencing. Tiger sequences were compared phylogenetically with 30 geographically associated human cases collected within 2 weeks of the outbreak and 233 Tennessee background sequences.

Results: Environmental assessment identified fencing between humans and animals allowing airflow and an outdoor exhibit observation point above the habitat. High-pressure hosing was used to wash the floors of the enclosure. Eighteen employees were interviewed; a tiger keeper and veterinary clinic assistant with COVID-19 were identified with onset after exposure to symptomatic tigers. SARS-CoV-2 sequences recovered from tigers, tiger keeper, and temporally associated cases from Tennessee belonged to Nextstrain clade 20G and Pangolin lineage B.1.2. Tiger sequences were 3–6 single nucleotide polymorphisms different from the positive tiger keeper.

Conclusions: SARS-CoV-2 infection in zoological settings has major public health implications, including transmission involving employees, visitors, and animals. This study reports naturally occurring tiger-to-tiger SARS-CoV-2 transmission, although the transmission route for employee illnesses was not confirmed. Employees with suspected or known infection should avoid contact with animals to avoid spread. Avoidance of high-pressure washing of symptomatic animal enclosures to avoid aerosolization of infectious particles should also be considered.

11:55 Dog Bite-Related Emergency Department Visits and Time-Sensitive Emergency Registry Records — Idaho, January 2017–October 2021

Authors: Megan E. Cahill, B. Morawski, K. Carter

Background: Dog bite injuries to people can result in physical and mental trauma and insurance claims averaging \$37,878/event in Idaho. Preliminary analysis indicated dog bite-related injuries resulting in hospitalization, death, or transfer between acute care hospitals reported to Idaho's Time-Sensitive Emergency (TSE) Registry increased from 2019 to 2020. We further examined dog bite-related TSE Registry records through December 2020 and emergency department (ED) visits through October 2021 to develop prevention message goals.

Methods: We analyzed dog bite-related TSE Registry records for injuries occurring during January 2017–December 2020 using *International Classification of Disease*, Tenth Edition, Clinical Modifications code W540XXA (bitten by dog, initial encounter) and ED visits during January 2018–October 2021 identified in Idaho's syndromic surveillance system. We compared patient demographic information and incident month using analysis of variance and chi-square tests. We

calculated dog bite-related ED visits to all ED visits by age group. We used SaTScan™'s discrete Poisson model to identify temporal clusters among dog bite-related ED visits.

Results: During 2017–2019, a range of 18–21 dog bite-related injuries were reported annually to the TSE Registry; 46 injuries, including 31 in children, were reported in 2020 ($P < 0.001$). By month, we saw a median of 2 dog bite-related TSE Registry records and 128 ED visits; TSE Registry records ($n = 10$) and ED visits ($n = 234$) were highest in July 2020. Monthly dog bite-related ED visits/1000 ED visits overall were highest among children (≤ 4 years, 6.65; 5–17 years, 7.53) vs. adults (≥ 18 years, 2.58). We identified seasonal clustering (May–September, $P = 0.001$) during 2018–2021 for dog bite-related ED visits.

Conclusions: Dog bite-related TSE Registry records and ED visits were highest among children and during summer, suggesting springtime safety messaging for child and dog interactions might be optimal.

12:15 Rabies Postexposure Prophylaxis Surveillance System: A Need for Data Modernization — Maryland, 2021

Authors: Molly A. Kreuze, M. Duwell, D. Blythe, D. Crum, L. Rebert, D. Curley

Background: Approximately 60,000 people receive rabies postexposure prophylaxis (PEP) annually in the United States, costing an estimated \$165 million. In Maryland, surveillance of this life-saving treatment is mandated by law. Although medical providers are primary administrators of PEP, local health departments (LHDs) are responsible for reporting PEP data to the Maryland Department of Health (MDH) through a paper-based system. We conducted a system evaluation to assess functionality and opportunities for improvement.

Methods: We conducted individual, unstructured, in-depth interviews lasting 30-to-60 minutes with five MDH personnel and two staff from two LHDs; one representing a large urban county, the other a small rural county. We identified interview themes using deductive methods. We analyzed data from MDH's PEP surveillance system during 2012–2017 and used the State Emergency Department Database to calculate sensitivity.

Results: In total, 9 of 24 (37.5%) LHDs, representing 39.4% of Maryland's population, including both urban and rural communities, did not report any PEP data to MDH. The surveillance system's sensitivity during 2012–2017 is estimated to be $< 60\%$ for all years and declined during that period. In 2012, sensitivity was 57%; whereas, in 2017 it was 21.8%. Interviewees reported that PEP data collection can be time-consuming and requires multiagency collaboration, including health care providers, animal control, LHDs, Maryland's public health laboratory, and MDH. Lack of a central data repository and interoperable systems to facilitate data sharing were frequently mentioned themes.

Conclusions: This paper-based system is limited by collaborators that do not use interoperable systems for data sharing, resulting in time-consuming investigations. Data modernization initiatives, including a centralized reporting system might reduce the burden on LHDs by simplifying data collection and sharing. Such initiatives might improve surveillance system sensitivity and data-driven policy, allowing MDH to track exposure trends, allocate resources, develop clinician educational materials, and ultimately save lives.

12:35 Delayed Diagnosis of a Case of Pneumonic Plague During a Respiratory Disease Pandemic — Wyoming, 2021

Authors: Allison W. Siu, C. Tillman, C. Van Houten, A. Busacker, A. Harrist

Background: *Yersinia pestis*, the causative agent of plague, is endemic in rodents and their fleas in Wyoming. In September 2021, the Wyoming Department of Health (WDH) was notified of a laboratory-confirmed case of pneumonic plague, a rare but serious disease that progresses without treatment and can spread between people through infected droplets. COVID-19 was initially suspected as cause of illness. The patient, hospitalized for cough, dyspnea, hemoptysis, and headache, was exposed to 2 ill domestic cats; 1 was euthanized without necropsy. We investigated to identify persons at risk for disease, determine source, and recommend control measures.

Methods: To determine exposure risk factors and guide postexposure prophylaxis (PEP) recommendations, we interviewed the patient's family and close contacts (defined as anyone <6 feet from patient during active hemoptysis). Additionally, we reviewed patient medical and veterinary records. CDC conducted *Y. pestis* serologic testing of the surviving cat. WDH contracted a private company to assess patient's property for ground squirrels, mice, and fleas.

Results: We identified 22 close contacts (19 hospital employees and 3 personal contacts). All received PEP within 1 week of patient's symptom onset; none developed illness. The patient tested negative for SARS-CoV-2 three times before *Y. pestis* diagnosis and treatment occurred, which was 4 days after hospitalization and 6 days after illness onset. The tested cat was negative for *Y. pestis* antibodies. Environmental treatment of patient's property was performed after rodent habitats were identified. The patient was discharged 35 days after hospitalization.

Conclusions: This investigation highlights delays in diagnosing and treating a rare respiratory pathogen during the COVID-19 pandemic, where symptoms are similar. Clinicians should consider *Y. pestis* infection in patients with compatible symptoms and exposure history in plague-endemic areas. Our investigation demonstrates need for clinician awareness to distinguish COVID-19 from rare respiratory illness to facilitate treatment and public health response.

CONCURRENT SESSION G2: Vaccine-Preventable and Respiratory Diseases

11:30 am–12:55 pm

Introduction: Stephanie Bialek

Moderator: Julia Gargano

11:35 Public Health Actions to Address Measles in Recently Evacuated Afghans Through Operation Allies Welcome, — September–October 2021

Authors: Nina B. Masters, A. Mathis, K. Raines, S. Crooke, B. Bankamp, P. Rota, D. Sugerman, F. Alvarado-Ramy, L. Rotz, M. Bell, L. Talley, P. Gastanaduy

Background: From August 29–November 1, 2021, 70,256 evacuees from Afghanistan were brought to the United States via Operation Allies Welcome (OAW). Evacuees were transported from seven overseas locations to eight U.S. military bases and two hotels. Following identification of measles among evacuees and given ~64% measles vaccine coverage and an outbreak in Afghanistan, CDC recommended a pause of incoming flights, mass measles vaccination of evacuees aged ≥6 months both domestically and overseas, and a 21-day quarantine after vaccination. We characterized cases, identified transmission patterns, and assessed outbreak control measures.

Methods: We conducted measles case and contact investigations. A case was defined as an acute febrile rash illness in a person and measles laboratory confirmation or epidemiologic link to a laboratory-confirmed case. Measles genotyping was performed at vaccine-preventable disease reference centers and CDC.

Results: Forty-seven measles cases (attack rate: 0.67/1,000 evacuees) were reported across five bases and one hotel in four jurisdictions (22 in Virginia, 22 in Wisconsin, 2 in New Mexico, 1 in New Jersey); rash onsets ranged from September 2–October 15. The median case age was 1 year (range: 0–26 years); all cases were unvaccinated or had unknown vaccination status. Thirty-seven sequenced specimens were genotype B3, consistent with genotypes detected in Afghanistan. Six separate transmission chains were identified (size: 1–22 cases, duration: 0–2 generations). Vaccination campaigns reached 99% coverage among eligible evacuees; before and after completion of mass vaccination, 0% and 22.7% of cases were aged <6 months, respectively. Twenty vaccinees developed measles after vaccination, with rash onsets 0–15 days following vaccination (median: 8 days). No community spread or fatalities were identified, and there were no importations following resumption of flights.

Conclusions: During OAW, a rapid, high-coverage vaccination campaign and 21-day quarantine reduced measles importations and spread at bases and in U.S. communities.

11:55 Geographic Variation of Invasive Pneumococcal Disease Serotypes in U.S. Adults ≥19 Years Following Introduction of 13-Valent Pneumococcal Conjugate Vaccine

Authors: Heidi L. Moline, R. Gierke, M. Farley, H. Talbot, A. Thomas, A. Reingold, L. Harrison, C. Holtzman, K. Burzlauff, S. Petit, M. Barnes, K. Angeles, L. McGee, T. Pilishvili, M. Kobayashi

Background: Introduction of 13-valent pneumococcal conjugate vaccine (PCV13) for U.S. children in 2010 decreased PCV13 vaccine-type (VT) invasive pneumococcal disease (IPD) incidence in both children and adults. Non-PCV13-type (NVT) cases comprise the majority of remaining IPD, but serotype-specific incidence may vary geographically. 15-valent and 20-valent pneumococcal conjugate vaccines (PCV15 and PCV20), recently recommended for U.S. adults, could reduce some of this remaining burden. We assessed changes in VT and NVT IPD incidence in adults post-PCV13 introduction across different U.S. sites, to inform evaluation of PCV15 and PCV20 impact.

Methods: IPD cases among adults aged ≥19 years were identified through CDC's Active Bacterial Core surveillance sites across 10 states during 2007–2019. Isolates were serotyped by Quellung or whole-genome sequencing and grouped as VT or NVT. We calculated percent changes in IPD incidence per

100,000 people during 2018–2019 compared to pre-PCV13 (2007–2008) by site and serotype group. We assessed the proportion of IPD caused by serotypes unique to PCV15 and PCV20.

Results: Overall IPD incidence decreased significantly (6%–43%) in 2018–2019 compared to 2007–2008 in all sites except Colorado, where no change occurred. VT IPD incidence decreased significantly (45%–85%) in all sites. A significant increase in NVT IPD was observed in Colorado, where a 24% increase was driven by PCV20/non-PCV13-serotypes. No changes in NVT IPD were observed in 2 sites, and decreases were observed in 7 sites. In 2018–2019, PCV15/non-PCV13-serotypes contributed to 6% (Colorado) to 22% (Minnesota) of overall IPD; PCV20/non-PCV13-serotypes contributed to 17% (California) to 39% (Tennessee) of overall IPD.

Conclusions: Following PCV13 introduction, reductions in overall and VT IPD incidence were consistent across sites, while the magnitude and direction of changes in NVT IPD incidence varied. PCV15 and PCV20 are expected to reduce overall IPD and NVT IPD, although impact may vary geographically.

12:15 Prescribing of Outpatient Antibiotics Commonly Used for Respiratory Infections Among Adults Before and During the COVID-19 Pandemic in Brazil

Authors: Dipesh Solanky, O. McGovern, F. Lessa, L. Hicks, S. Tsay, T. Patel, P. Patel

Background: Antibiotic resistance (AR) accounts for approximately 700,000 deaths annually worldwide. The COVID-19 pandemic amplifies AR concerns, partly from inappropriate antibiotic use for COVID-19, which increases risk of emerging resistance. Brazil was the epicenter of a new COVID-19 variant in quarter four (Q4) of 2020 with the most cases in Latin America, raising concerns of antibiotic overuse. We evaluated prescribing changes in antibiotics used for outpatient respiratory infections (amoxicillin-clavulanate, azithromycin, and levofloxacin or moxifloxacin [AALM]) among Brazilian adults in 2020 versus 2019.

Methods: We analyzed national projections of outpatient antibiotic prescriptions from the IQVIA MIDAS® Medical Dataset for AALM prescribing by age group (20–39; 40–59; 60–64; 65–74; ≥75), comparing Q4 2020 rates to those in Q4 2019. We estimated crude rate ratios and 95% confidence intervals (CIs) using prescription number as the numerator (assuming Poisson counts) and age-adjusted population as the denominator.

Results: Compared to Q4 2019, Q4 2020 azithromycin prescribing increased among all ages, ranging from 90.7% (95% CI: 90.0–91.4) in ages 20–39 to 927.2% (95% CI: 912.9–941.7) in ages 65–74. Amoxicillin-clavulanate prescribing decreased for most groups, ranging from -78.4% (95% CI: -78.7– -78.1) in ages 60–64 to -25.8% (95% CI: -26.6– -25.0) in ages 65–74. Levofloxacin or moxifloxacin prescribing decreased for most groups, ranging from -39.1% (95% CI: -39.4– -38.8) in ages 20–39 to -16.9% (95% CI: -18.1– -15.7) in ages 60–64. For ages ≥75, prescribing of amoxicillin-clavulanate and levofloxacin or moxifloxacin increased by 13.2% (95% CI: 11.9–14.5) and 43.1% (95% CI: 41.7–44.5), respectively.

Conclusions: While Brazil's outpatient amoxicillin-clavulanate and respiratory fluoroquinolone prescribing declined among most adults in 2020, azithromycin prescribing increased dramatically, likely from widespread use treating COVID-19. Optimizing azithromycin prescribing in Brazil during the COVID-19 pandemic is needed to mitigate AR risk.

12:35 Genome-Based Prediction of Cross-Protective, T Cell-Inducing Targets as Novel Vaccine Antigens for Multiple *Bordetella* Species

Authors: Muktha S. Natrajan, M. Weigand, Y. Peng, M. Williams, M. Momin, F. Damron, M. Tondella, L. Pawloski

Background: Acellular pertussis vaccines (aPVs) protect against severe disease caused by the bacteria *Bordetella pertussis*, but immunity wanes over time, and the introduction of aPVs has been associated with a resurgence in U.S. pertussis cases. Previous studies have shown that aPVs do not elicit T-cell responses necessary for long-lasting immunity or protect against other *Bordetella* species that cause pertussis-like illness. We aimed to identify potential new vaccine antigens that are predicted to engage T-cells and provide cross-protective immunity against multiple *Bordetella* species.

Methods: Whole genome sequence data were collected by our laboratory for 743 *B. pertussis*, 82 *B. parapertussis*, and 64 *B. holmesii* isolates. Immunoinformatics strategies determined highly homologous proteins among the three species, predicted T-cell inducing proteins (immunogenicity scores), and excluded proteins with cross-reaction to human proteins or commensal bacteria (BLASTp). Expression levels of selected targets were screened using RNASequencing and proteomics

and confirmed by qRT-PCR. Epitope identification was carried out using T-cell epitope prediction methods (IEDB.org) to identify a list of potential novel vaccine antigens.

Results: From the *B. pertussis* genome, 408/3631 genes had high homology with both *B. parapertussis* and *B. holmesii*, and 64/408 genes were identified as having high immunogenicity scores and low cross-reactivity with human proteins. Of these, 32/64 proteins were detectable at both the mRNA and protein level, and 12/32 proteins were *Bordetella*-specific. We confirmed that 8/12 protein targets, having 36 predicted immunogenic epitopes, were expressed across all three species.

Conclusions: We identified thirty-six cross-protective, detectable, and specific immunogenic epitopes predicted to induce T-cell responses and long-term immunity to *Bordetella* species. The immunogenicity of these targets will be confirmed through functional assays and add to the creation of a safe and durable vaccine to reduce the incidence of *Bordetella* infections and supplement prevention and control strategies to reverse the resurgence in pertussis cases.

CONCURRENT SESSION G3: HIV and STDs

11:30 am–12:55 pm

Introduction: Demetre Daskalakis

Moderator: Xia Michelle Lin

11:35 Demographic and Clinical Factors Associated with a Decrease in HIV Diagnoses During the SARS-CoV-2 Pandemic — Georgia, 2020

Authors: Jenna R. Gettings, C. Drenzek, P. Wortley

Background: During the COVID-19 pandemic, changes in health care-seeking behaviors and delivery of care decreased routine HIV testing, a critical strategy for early diagnosis and reducing transmission. In Georgia, HIV diagnoses decreased 17% from 2019 to 2020; whereas annual decreases in HIV diagnoses during 2015–2019 was 2%–5%. We sought to identify factors associated with decreases in diagnoses to determine whether focused messaging or interventions are needed to increase testing and reduce delays in diagnoses.

Methods: Data from Georgia's Enhanced HIV/AIDS Reporting System were used to identify persons who received an HIV diagnosis in 2019 and 2020. We assessed differences between the 2019 and 2020 cohorts for demographic characteristics, transmission category, census tract-level poverty, county urban classification, diagnosing facility type, and first CD4 count (<200 and ≥200 cells/ul). Statistical significance of the difference in proportions was assessed with z-tests.

Results: In 2019, a total of 2,449 people received an HIV diagnosis; in 2020, it was 2,018 people. Proportion of diagnoses among people aged 13–24 years was significantly lower in 2020 vs. 2019 (23.0% [464/2,018] vs. 26.1% [638/2,449], respectively). No significant differences were reported across race, ethnicity, transmission category, poverty levels, or urban classification. Health departments and blood banks and plasma centers represented a lower proportion of diagnosing facilities in 2020 vs. 2019 (8.9% [173/1,945] vs. 11.6% [267/2,308] and 1.6% [31/1,945] vs. 2.9% [67/2,308], respectively). Proportion with CD4 count ≥200 cells/ul at diagnosis was lower in 2020 (74.4% [1,369/1,839] vs. 77.0% [1,751/2,275]) but not statistically significant.

Conclusions: People who received an HIV diagnosis in 2019 and 2020 did not differ across demographic factors, indicating changes in health care-seeking behaviors and health care access were widespread. Thus, broad messaging on the importance of HIV testing and interventions to offset decreased testing are needed in multiple settings along with continued monitoring.

11:55 Racial/Ethnic Differences in Psychosocial and Structural Factors and HIV Risk Among Transgender Women — Seven Urban Areas, 2019–2020

Authors: Rebecca B. Hershow, L. Trujillo, E. Olansky, C. Agnew Brune, K. Lee, C. Wejnert, M. Adams; for the National HIV Behavioral Surveillance Among Transgender Women Study Group

Background: Psychosocial and structural factors, including polydrug use and homelessness, frequently co-occur and might jointly increase HIV risk. Few studies have assessed racial/ethnic differences in exposure to psychosocial and structural factors and HIV risk among transgender women. We examined the relationship between psychosocial and structural factors and HIV risk among African American/Black, Hispanic/Latina, and White transgender women in U.S. urban areas to inform HIV prevention interventions for transgender women.

Methods: During 2019–2020, transgender women in 7 sites were recruited using respondent-driven sampling (RDS) for a biobehavioral survey. Using modified Poisson regression to account for RDS, we assessed whether the relationship between psychosocial and structural factors (polydrug use, sexual violence, psychological distress, homelessness, incarceration, and gender identity-related discrimination) and HIV risk differed by race/ethnicity among HIV-negative participants by testing interactions. HIV risk was defined as past-year

condomless sex and exchange sex. Reported psychosocial and structural factors were summed.

Results: Of 761 HIV-negative transgender women (n = 209 Black; n = 407 Hispanic; n = 145 White), 64.7% reported condomless sex and 34.7% reported exchange sex; 35.4% reported ≥ 3 psychosocial and structural factors. Reporting more factors was associated with condomless sex (adjusted prevalence ratio [aPR]: 1.09; 95% CI: 1.07–1.12); there were no racial/ethnic differences. There was an association between psychosocial and structural factors and exchange sex among White (aPR: 1.55; 95% CI: 1.30–1.85), Black (aPR: 1.28; 95% CI: 1.18–1.40), and Hispanic (aPR: 1.21; 95% CI: 1.13–1.31) participants. The association was significantly stronger for White than Hispanic participants.

Conclusions: Increased exposure to psychosocial and structural factors was associated with heightened HIV risk among transgender women. Racial/ethnic differences in associations with exchange sex suggest White transgender women might be differentially affected by these factors. HIV prevention efforts for transgender women should address co-occurring psychosocial and structural factors.

12:15 Extragenital Chlamydia and Gonorrhea Testing Among Sexually Active Men Who Have Sex with Men — United States, 2017–2020

Authors: Yasmin P. Ogale, A. Ridpath, R. Kirkcaldy, T. Sanchez, W. Abara

Background: Extragenital (rectal and pharyngeal) anatomic sites might serve as reservoirs for gonorrhea and chlamydia. Particularly among men who have sex with men (MSM), extragenital sexually transmitted infections (STIs) are prevalent and might facilitate gonococcal antimicrobial resistance and HIV transmission. However, extragenital STIs are often asymptomatic and detected only through screening; genital testing alone might result in undetected STIs. CDC recommends urethral and rectal chlamydia testing and urethral, rectal, and pharyngeal gonorrhea testing at least annually among MSM. We describe the prevalence of extragenital testing among an online sample of MSM in the United States.

Methods: Using data from the American Men's Internet Survey (2017–2020), we calculated the number of MSM who reported genital and extragenital gonorrhea or chlamydia tests in the past year. We calculated adjusted prevalence ratios (aPRs) and 95% CIs to compare extragenital testing across demographic, clinical, and behavioral factors.

Results: Of 43,389 participants, 13,171 (30.4%) reported any gonorrhea or chlamydia testing and 7,726 (17.8%) reported extragenital testing (1,561 [20.2%] only pharyngeal, 1,060 [13.7%] only rectal, and 5,105 [66.1%] both). Factors associated with extragenital testing included disclosure of same-sex sexual behavior to their health care provider (aPR: 1.32; 95% CI: 1.22–1.42), having ≥ 2 male partners (aPR: 1.19; 95% CI: 1.12–1.27), and illicit drug use (aPR: 1.08; 95% CI: 1.04–1.12). MSM who reported extragenital testing were more likely to be diagnosed with gonorrhea (aPR: 2.06; 95% CI: 1.88–2.27) or chlamydia (aPR: 2.02; 95% CI: 1.84–2.22) than those who reported urogenital testing alone.

Conclusions: Extragenital screening appeared to be suboptimal among these MSM. To reduce risk of missed STIs and subsequent community transmission, health care providers are encouraged to identify risk factors by taking sexual histories, screening for drug use, and adhering to STI screening recommendations for MSM.

Authors: Robert A. Bonacci, A. Moorman, D. Bixler, M. Penley, S. Wilson, A. Hudson, S. Perez, P. Salvatore, K. Curran, R. Hershow, A. Oster, J. Hoffman, E. Thomasson, V. Hogan, M. Boltz, R. McClung

Background: In 2019, the West Virginia (WV) Bureau for Public Health detected an increase in HIV diagnoses among people who inject drugs (PWID) in Kanawha County, an area disproportionately affected by the opioid crisis. Because most HIV diagnoses among PWID occurred in health care settings, we explored health care use and service delivery among PWID during the outbreak to identify opportunities for HIV- and opioid-related interventions.

Methods: We reviewed medical records of PWID residing in Kanawha County with HIV diagnosed during January 1, 2019–June 18, 2021; records were obtained from the county’s largest medical system and a community clinic serving PWID. We conducted descriptive analyses of health care encounter and HIV- and opioid-related services data from 1 year before HIV diagnosis through June 18, 2021.

Results: Among 65 HIV-positive PWID, we identified 496 health care encounters during 127 person-years of follow-up, including 307 (62%) acute care (emergency department/inpatient) encounters and 189 (38%) outpatient encounters. There were 181 (36%) encounters for injection drug use-associated bacterial infections and 17 (3%) for overdose. Among 291 opioid-related encounters, prescriptions of naloxone (overdose reversal medication) and medication for opioid use disorder (MOUD) were documented at 28 (10%) and 58 (20%) encounters, respectively. Sixty-three HIV screening tests were performed, and no one was prescribed preexposure prophylaxis to prevent HIV infection. Four people (6%) received sterile syringes. For 80 (26%) acute care encounters, patients left care against medical advice.

Conclusions: We found high health care use among PWID during the outbreak and identified missed opportunities to prevent HIV transmission through testing and preexposure prophylaxis and to address opioid use through naloxone, MOUD, and sterile syringes. Health care settings, especially acute care settings based on the frequency of encounters, should ensure that HIV prevention and opioid-related services are routinely integrated into each care encounter for PWID.

🏆 **SESSION H: Alexander D. Langmuir Lecture**

1:25–2:45 pm

Moderators: Rochelle Walensky and Patricia Simone



**Mary T. Bassett,
M.D., M.P.H.**

Presentation of the Alexander D. Langmuir Award

Presenter: Gus Birkhead, EIS Alumni Association President

Undoing the Racial Patterning of Health

Mary T. Bassett, M.D., M.P.H.

Biography

Mary T. Bassett, M.D., M.P.H., was appointed Acting Commissioner of Health on December 1, 2021 and confirmed by the New York State Senate on January 20, 2022. She previously served as Director of the François-Xavier Bagnoud (FXB) Center for Health and Human Rights at Harvard University and FXB Professor of the Practice of Health and Human Rights in the department of Social and Behavioral Sciences at the Harvard T.H. Chan School of Public Health. Prior to that, she served as Commissioner of the New York City Department of Health and Mental Hygiene, Director for the Doris Duke Charitable Foundation's African Health Initiative and Child Well-Being Prevention Program; and as Deputy Commissioner of Health Promotion and Disease Prevention at the New York City Department of Health and Mental Hygiene.

Early in her career, Dr. Bassett served on the medical faculty at the University of Zimbabwe and went on to serve as Associate Director of Health Equity at the Rockefeller Foundation's Southern Africa Office. After returning to the United States, she served on the faculty of Columbia University, including as Associate Professor of Clinical Epidemiology in the Mailman School of Public Health. Dr. Bassett received a B.A. in History and Science from Harvard University, an M.D. from Columbia University's College of Physicians and Surgeons, and an M.P.H. from the University of Washington.

🏆 *Awards presented during session.*

CONCURRENT SESSION 11: Infections in Healthcare Settings

3:15–4:40 pm

Introduction: Denise Cardo

Moderator: Amy Schumacher

3:20 Cluster of Invasive Mucormycosis at an Acute Care Hospital – Arkansas, 2019–2021

Authors: Karen Wu, A. Jordan, A. James, J. Gold, J. Glowicz, F. Wolfe, K. Vyas, A. Litvintseva, L. Gade, H. Liverett, M. Alverson, M. Burgess, A. Wilson, R. Li, I. Benowitz, T. Gulley, N. Patil, R. Chakravorty, W. Chu, A. Kothari, B. Jackson, K. Garner, M. Toda

Background: In February 2020, Hospital A notified the Arkansas Department of Health and CDC of a cluster of mucormycosis cases in a hematologic malignancy unit. Mucormycosis is an uncommon but life-threatening fungal infection caused by mucormycetes. Healthcare-associated mucormycosis (HM) outbreaks have been attributed to multiple environmental sources, including contaminated medical products (e.g., bandages, medications), ventilation systems (e.g., inadequate air filtration), and improperly managed healthcare linens. We investigated to identify potential sources and prevent further infections.

Methods: We defined a case of HM as culture-histopathology- or polymerase chain reaction-confirmed invasive mucormycosis diagnosed ≥ 7 days after hospital admission during June 2019–June 2021. To identify possible sources of infection, we examined common patient exposures (e.g., shared patient locations, procedures, and products), performed targeted environmental assessments of Hospital A, and systematically sampled linens (i.e., towels, sheets). Hospital A staff performed a walkthrough inspection of the offsite contracted laundry provider.

Results: Seventeen HM cases were identified at Hospital A spanning multiple units and time periods; cases were not linked by common procedures or products. The ventilation system supplying the hematologic malignancy unit was functioning properly and received adequate maintenance. Investigation identified a lack of proper environmental control standards at the offsite laundry facility to protect laundered linens from the outdoor environment and suboptimal handling of laundered healthcare linens (e.g., inadequate separation of clean and soiled areas of the receiving dock) at Hospital A. We detected mucormycetes on 9/98 (9%) linens sampled at the hospital, including on linens upon arrival from the laundry provider.

Conclusions: We identified healthcare linens as a potential source of the outbreak and highlighted opportunities to improve the handling of laundered healthcare linens to decrease the risk for contamination. Hospital A refined their linen handling process to address potential sources of contamination.

3:40

COVID-19 Outbreak Among Residents at a Skilled Nursing Facility — Chicago, Illinois, April 2021–June 2021

Authors: Richard A. Teran, E. Shane, D. Galanto, C. Zelinski, M. Heppe, X. Qiu, S. Green, S. Ladd, L. Furtado, H. Choi, I. Ghinai, M. Pacilli, K. Walblay, S. Black

Background: In April 2021, the Chicago Department of Public Health (CDPH) was notified of a resident with COVID-19 at a skilled nursing facility (SNF). We initiated an investigation to address infection prevention and control concerns, monitor outcomes, evaluate healthcare personnel (HCP) and resident SARS-CoV-2 screening practices, and prevent further transmission.

Methods: A confirmed SARS-CoV-2 case was defined as a positive SARS-CoV-2 nucleic acid amplification or antigen test result from a respiratory specimen collected from a Chicago SNF-associated resident or HCP. Positive SARS-CoV-2 test results, facility testing logs, and vaccination were confirmed using Illinois' surveillance system and vaccine registry. Prior to the outbreak, CDPH required facilities to screen HCP every 14 days. Available SARS-CoV-2 positive specimens were submitted for whole genome sequencing, assigned a lineage, and evaluated for relatedness.

Results: Fourteen SARS-CoV-2 cases were identified: 13 (93%) among residents and 1 (7%) in a HCP. Six (43%) cases occurred among fully vaccinated persons, 7 (50%) reported symptoms, 5 (36%) were hospitalized, and 2 (14%) persons died. When the outbreak was identified, 31 (24%) of 129 HCP designated for screening had not been tested in the last 14 days and 7 (5%) had no record of testing. Of 13 available residual specimens, six (46%) were successfully sequenced. All sequences were of the P.1 (Gamma) lineage; phylogenetic analysis suggested highly related sequences from a single transmission chain.

Conclusions: Investigation of a SARS-CoV-2 outbreak in a SNF revealed screening testing noncompliance among HCP and untested HCP working at the facility at the time of the outbreak. Full compliance with Illinois' screening testing requirements might have prevented transmission among SNF residents and HCP. To prevent SARS-CoV-2 transmission, facilities should perform screening of HCP; asymptomatic HCP and residents with known exposure and persons with any COVID-19 symptoms should be tested regardless of vaccination status.

4:00

Severity and Transmissibility of Tuberculosis Disease Among Recipients of Bone Allograft Containing Tuberculosis — United States, 2021

Authors: Thomas D. Filardo, N. Schwartz, S. Althomsons, A. Hernandez-Romieu, M. Deutsch-Feldman, W. Wilson, R. Li, J. Glowicz, R. Free, P. Annambhotla, S. Basavaraju, I. Benowitz, M. Haddad, J. Wortham, S. Bamrah Morris

Background: In 2021, a single lot of human bone allograft product ("the product") that contained *Mycobacterium tuberculosis* (*Mtb*) caused one of the largest tuberculosis outbreaks in recent U.S. history. Current transplant protocols do not require *Mtb* testing of tissue, and little is known about the severity and transmissibility of tuberculosis acquired through tissue allografts. We investigated this multistate tuberculosis outbreak to identify attack rates, sites of infection, and the potential for secondary transmission.

Methods: Our cohort included all persons who underwent surgical implantation with the product during March–June 2021. We collaborated with affected health departments and health care facilities to gather clinical findings through standardized case report forms. We defined evidence of tuberculosis disease as positive microbiologic testing or compatible imaging findings. Opportunities for secondary transmission included aerosolization of infected material

during surgical revision, draining surgical site wounds, and pulmonary tuberculosis.

Results: In total, 113 persons received the product during spinal (n = 112) or foot (n = 1) surgery. Eighty-seven (77%) persons had evidence of tuberculosis disease, including 83 (73%) with surgical site disease. Median time from product implantation to first microbiologic or imaging evidence of tuberculosis was 65 days (range: 9–130 days). Of those with available data, 48 of 111 (43%) underwent surgical revisions and 26 of 110 (24%) had draining wounds. Overall, 40 of 61 (66%) specimens from surgical sites had acid-fast bacilli visible on smear microscopy—a marker of infectiousness. Pulmonary tuberculosis was diagnosed in 27 (24%) persons, suggesting hematogenous spread of infection.

Conclusions: Surgical implantation of bone allograft product that contained *Mtb* caused a high incidence of surgical site and pulmonary tuberculosis. Opportunities for secondary transmission were common. Given the potential for allograft-derived tuberculosis to cause severe disease and to generate secondary transmission, *Mtb* testing of tissue allografts before implantation should be considered.

Authors: Molly Deutsch-Feldman, R. Li, A. Romieu-Hernandez, T. Adams, E. Pitcher, B. Chinpar, K. White, M. Law, A. Martinez, T. Cropper, S. Althomsons, I. Benowitz, N. Schwartz, J. Glowicz, M. Haddad

Background: In 2021, bone allograft material containing *Mycobacterium tuberculosis* (*Mtb*) was surgically implanted into 113 persons nationwide, resulting in one of the largest tuberculosis outbreaks in recent U.S. history. In one Indiana hospital system, 11 patients received the contaminated material. All recipients had drains immediately following surgery, and 4 subsequently developed draining *Mtb* wounds. Although respiratory transmission of *Mtb* is well understood, the risk of transmission from surgical sites, wounds, and equipment is not. We conducted a contact investigation to determine the extent of transmission to health care personnel (HCP) within this hospital system.

Methods: We reviewed medical records to identify HCP exposures to *Mtb*. HCP who, without using Airborne Precautions, shared airspace with a bone graft recipient during the operative or immediate postoperative period (while the patient had a surgical drain) or encountered active wound

drainage, contaminated equipment, or pulmonary tuberculosis were defined as exposed. Exposed HCP were evaluated for *Mtb* infection by immunoassay.

Results: Preliminary assay results were available for 1,026 of approximately 2,250 exposed HCP. Twenty-one HCP (2%) who had tested negative for *Mtb* infection within the past 24 months tested positive following exposure. Documented exposures for 12 of these HCP were from surgical sites, wounds, or equipment: 4 operating room staff, 2 inpatient unit staff, 2 endoscopy unit staff, 1 physical therapist, 2 sterile processing staff, and 1 laboratory staff. Nine additional HCP in radiologic imaging, the emergency department, and inpatient settings tested positive.

Conclusions: At least 21 HCP had evidence of recent infection, suggesting *Mtb* transmission from surgical site, wound, or equipment exposures, although other unknown exposures cannot be excluded. To reduce transmission, HCP caring for patients with draining *Mtb* wounds should adhere to Airborne Precautions. The variety of affected hospital roles supports the broad testing strategy in the context of this unprecedented outbreak.

CONCURRENT SESSION 12: Recreational Risks

3:15–4:40 pm

Introduction: Jay Butler

Moderator: Jennifer Cope

3:20 Multijurisdictional *Giardia* Outbreak Associated with an Outdoor Film Site — Ventura County, 2021

Authors: Auguste A. Brihn, E. Traub, A. Amoon, D. Marks, H. Edmundson, R. Levin, P. Gounder

Background: *Giardia duodenalis*, a parasite that causes gastrointestinal illness, can be transmitted by ingesting contaminated food or water. Approximately 300–350 *Giardia* cases/year are reported to Los Angeles County Department of Public Health (LACDPH); outbreaks are uncommon. In June 2021, LACDPH received numerous reports of *Giardia* cases associated with a large, water-themed outdoor television game show production site in neighboring Ventura County. We investigated to determine the source and prevent additional illness.

Methods: Cases were defined as laboratory-confirmed *Giardia* or any reported gastrointestinal symptoms in a person who spent ≥ 1 day on the production site from March 3–June 2, 2021. We conducted an environmental assessment of the production site and catering company; samples were collected from cattle pen and water sites administered a survey assessing potential exposures; and conducted a cohort analysis to assess association with illness.

Results: Among 508 employees and contestants, 322 (63%) responded to the survey. We identified 144 (45%) cases, including 41 (13%) laboratory-confirmed illnesses. No caterer food handling violations were observed during inspection. The production site included a cattle pen, chicken coop, and pond. Exposure to pond water used for dust suppression had the strongest association with illness (risk ratio: 2.4; 95% CI: 1.9–3.1). *Giardia* was identified in cattle manure but not pond water.

Conclusions: We describe a large *Giardia* outbreak in a water-themed outdoor game show television production site. Although exact transmission source was not identified, *Giardia* was identified in the cattle manure and exposure to pond water used for dust suppression was strongly associated with illness, suggesting fecal contamination of pond water was a likely source. People working in proximity to cattle and bodies of nonpotable water should take precaution to mitigate exposures to *Giardia*, including nonpotable water signage, not using nonpotable water near people and emphasizing hand hygiene.

3:40

SARS-CoV-2 Transmission Associated with an Indoor Music Club Event that Required Proof of Full Vaccination Against COVID-19 Prior to Entry — King County, WA, July 2021

Authors: Mellisa Roskosky, G. Moni, V. Kawakami, J. Lambert, C. Brostrom-Smith, H. Whitney, A. Phu, J. Look, A. Pallickaparambil, M. Kay, J. Duchin

Background: On July 16, 2021, Public Health – Seattle & King County (PHSKC) was notified of two COVID-19 cases in persons who attended the same indoor music event on July 9, 2021. At that time, the 7-day COVID-19 average incidence in King County was 30.75 per 100,000 population. Full COVID-19 vaccination was required and supposed to be verified upon entry; mask wearing was not required for vaccinated persons under the Washington Ready Plan.

Methods: PHSKC investigated to characterize transmission risk factors, conduct case finding, and prevent further spread of SARS-CoV-2. A case was defined as a positive SARS-CoV-2 by RT-PCR or antigen test result from July 9–23, 2021 in persons who attended the event. Fully vaccinated persons received the final dose of their series before June 25, 2021. Vaccination status was confirmed for cases through the Washington Immunization Information System. PHSKC conducted an

onsite assessment of the venue on July 30, 2021, including evaluation of ventilation and air filtration.

Results: Twenty-four cases (22 in attendees, 2 in staff) were reported among 360 attendees and 14 staff. Two secondary cases (close contact of confirmed case) were identified. Event organizers confirmed that vaccination was verified for attendees, but not staff. Among the cases, all attendees and 1 staff were fully vaccinated. No hospitalizations or deaths were identified. On-site assessment determined one unvaccinated employee reported working while symptomatic and later tested positive, and that the venue had poor ventilation and was likely over capacity. The venue had no COVID-19 mitigation plan, vaccination tracking system, or masking requirement for staff.

Conclusions: This outbreak shows that COVID-19 is transmissible among highly vaccinated, unmasked groups in indoor, poorly ventilated spaces and where physical distancing is not feasible. Implementation of COVID-19 mitigation plans, including vaccination verification and ventilation improvements, is recommended to reduce spread in these settings.

4:00

Splash Pad Associated Fatal *Naegleria fowleri* Infection in a 3-year-old Child — Texas, 2021

Authors: Denisse Vega Ocasio, M. Hlavsa, M. Mattioli, I. Ali, A. Kahler, T. Brown, A. Rountree, S. Roy, C. Cummings, A. Wolfe, M. O' Bryan, C. Cook, R. Wallace, A. Cheney, J. Cope

Background: *Naegleria fowleri*, commonly known as the “brain-eating amoeba”, can be found in warm freshwater (e.g., lakes) and inadequately disinfected aquatic venues (e.g., pools and splash pads). The amoeba causes primary amoebic meningoencephalitis (PAM) when water containing the amoeba enters the nose. While infections are rare, >95% are fatal. In August 2021, a 3-year-old child developed PAM-like symptoms and died. We aimed to confirm *N. fowleri* infection, determine source of infection, and develop prevention recommendations.

Methods: We tested the child’s cerebrospinal fluid (CSF) for *N. fowleri* using real-time polymerase chain reaction (PCR) and interviewed the child’s parents to determine water exposures. We collected sediment, large-volume ultrafiltered water, and surface swab samples from the storage tanks, nozzles, and drains of the splash pad, where the child had recently played. We performed PCR testing on environmental samples for *N. fowleri* and assessed viability by culturing. We inspected

the splash pad based on CDC’s Model Aquatic Health Code (MAHC) operation and management standards.

Results: *N. fowleri* was detected in the child’s CSF. Interviews revealed that the child played in a water playground in the week preceding illness, leading to closure of the splash pad to the public. Viable *N. fowleri* was detected in the samples collected from the splash pad nozzles, drains, and collection tank. Inspection of the splash pad found inadequate disinfection likely due to an inoperable filter, lack of regular tank cleaning, and lack of monitoring and adjustment of the water’s chlorine concentration.

Conclusion: This multidisciplinary investigation identified a PAM case associated with a water playground. To prevent additional cases, CDC recommended regular monitoring and adjustment of disinfectant, proper filtration, and regular tank cleaning. This investigation underscores the importance of following CDC’s MAHC recommendations for proper operation and management of splash pad, which are similar to recommendations for pools.

Authors: Elizabeth C. Ohlsen, S. Stous, T.M. McMichael, A. Kao, A. Murphy Schafer, M. Beatty, S. Shah

Background: In August 2021, the U.S. Coast Guard notified the County of San Diego Health and Human Services Agency of persons with COVID-19 symptoms on a 9-day charter fishing cruise. We conducted an investigation to identify and rapidly isolate infected persons to reduce the chance of onward transmission.

Methods: Disembarking persons (8 crew; 33 passengers) were asked about COVID-19 symptoms. Anterior nares swabs were collected from everyone except one symptomatic crewmember who sought emergency care. Samples from persons denying symptoms were rapid antigen SARS-CoV-2 tested and submitted for RT-PCR. Samples from persons reporting symptoms were submitted for RT-PCR only to confirm prior positive self-administered antigen testing onboard. Whole-genome sequencing was performed on RT-PCR positive samples with sufficient isolate. Crew, passengers, and tour operator were interviewed to determine mitigation practices used.

Results: Of 41 persons on board, only 4 crew members reported symptoms. Among 37 asymptomatic persons, 6 tested positive (2 crew; 4 passengers) on both dockside rapid antigen and RT-PCR, and 5 tested positive (0 crew; 5 passengers) on RT-PCR only. All 3 of the symptomatic crew members tested by RT-PCR were confirmed positive; the fourth symptomatic crew member was unavailable for sample collection. Of the 14 positive specimens, 10 were suitable for sequencing and all were SARS-CoV-2 Delta variant AY.25. Epidemiologic investigation identified crew exposure to an infectious passenger on a tour ending the day before departure. Tour operators observed everyone boarding the vessel self-testing antigen-negative dockside the morning of departure. Vaccination was not required, and masks were not routinely worn onboard.

Conclusions: SARS-CoV-2 spread among crew and passengers during this 9-day cruise after crew exposure to an individual with SARS-CoV-2 infection on a previous cruise. An outbreak response combining dockside rapid antigen testing with isolation and quarantine guidance potentially reduced forward transmission to family members and future passengers.

CONCURRENT SESSION 13: Chronic Disease and Emergency Preparedness

3:15–4:40 pm

Introduction: Karen Hacker

Moderator: Dianna Carroll

3:20 Knowledge of FDA-Approved Smoking Cessation Medications by Healthcare Providers — DocStyles, 2020

Authors: Thomas M. Golden, B. VanFrank, E. Courtney-Long

Background: Cigarette smoking is the leading cause of preventable disease and death in the United States; 34 million US adults smoke cigarettes. There are 7 FDA-approved medications for smoking cessation, but these treatments are underutilized. Healthcare providers play a critical role in connecting patients to cessation treatments. We assessed knowledge of cessation medications by healthcare providers and associations with clinical practice characteristics.

Methods: We used responses from 1,480 non-pediatric US healthcare providers who completed the DocStyles 2020 web-based panel survey. Providers were asked to select FDA-approved smoking cessation medications from a list. Knowledge was categorized (low, medium, high) by the number of correct vs. incorrect medications selected. Multivariable modeling was used to calculate adjusted odds ratios (aOR) and 95% confidence intervals (95% CI) for clinical practice characteristics associated with score (low/medium vs. high). Covariates were clinical practice (specialty, inpatient/outpatient, patient volume, years practicing, and patient annual income) and personal characteristics (sex, race/ethnicity, and region).

Results: Overall, 2.9% of respondents scored low, 57.0% medium, and 40.1% high. Family physicians performed best among specialties; 50.6% scored high. OB/GYNs had the largest proportion who scored low (5.6%). Compared to internists, OB/GYNs were more likely to score low/medium (aOR: 2.62; 95% CI: 1.82–3.76); family physicians were less likely to score low/medium (aOR: 0.69; 95% CI: 0.53–0.90). Compared to providers indicating most patients had an annual income <\$50k, those indicating most patients had an annual income ≥\$100k were more likely to score low/medium (aOR: 1.56; 95% CI: 1.18–2.07).

Conclusions: Significant associations were noted among respondent knowledge category and specialty, as well as the annual income of patients. Less than half of respondents scored high, suggesting opportunity to improve provider knowledge of cessation medications. Public health and healthcare providers can collaborate to expand provider knowledge of evidence-based cessation therapies.

3:40

Perspectives on Counseling Women of Reproductive Age About Emergency Preparedness by Primary Healthcare Providers — DocStyles, United States, 2021

Authors: Jessica R. Meeker, R. Simeone, C. Shapiro-Mendoza, M. Snead, R. Hall, S. Ellington, R. Galang

Background: Pregnant, postpartum, and lactating women (PPLW) face unique challenges during disasters that may be mitigated by emergency preparedness. Healthcare providers have opportunities to counsel this population on emergency preparedness, but the extent of counseling provided has not been reported. Our objective is to report healthcare provider attitudes and practices related to counseling women of reproductive age (WRA), including PPLW, on emergency preparedness.

Methods: DocStyles, a web-based panel survey of a convenience sample of primary healthcare providers in the United States, was conducted March 17–May 17, 2021. Family practitioners, internists, obstetricians-gynecologists, nurse practitioners, and physician assistants were asked about the importance of emergency preparedness counseling, level of confidence in counseling, frequency of counseling, barriers to providing counseling, and preferred resources to support counseling among their patient populations, specifically WRA and PPLW. We calculated frequencies of provider attitudes and practices by using R version 4.0.3.

Results: Among 1,503 respondents, family practitioners (33%), internists (34%), obstetrician-gynecologists (17%), nurse practitioners (8%), and physician assistants (8%), 88% thought that emergency preparedness for keeping reproductive-aged patients safe, and counseling patients of reproductive age about emergency preparedness were both important. However, 45% of respondents were not confident in counseling WRA about emergency preparedness for disasters, and most (70%) had never talked to PPLW about this topic. Respondents cited not having time during clinical visits (48%) and lack of preparedness knowledge (34%) as barriers to providing counseling. Most respondents (79%) stated they would use educational materials, if available, especially fact sheets or brochures and patient text alerts.

Conclusions: Most respondents thought counseling WRA and PPLW on emergency preparedness for disasters was important; however, many have not provided such counseling, noting lack of time and knowledge as common barriers. Emergency preparedness resources combined with training may improve healthcare provider confidence in counseling WRA and PPLW.

4:00

County-Level Associations of Structural and Social Determinants of Health with Gestational Diabetes Prevalence — United States, 2019

Authors: Michele L.F. Bolduc, C. Mercado, E. Lundeen, K. Bullard, D. Carty, N. Ford, Y. Zhang

Background: Women who develop gestational diabetes mellitus (GDM) during pregnancy are at increased risk of pregnancy complications and developing type 2 diabetes later in life. We conducted an ecological analysis to explore whether county-level demographics and social determinants of health were associated with county-level GDM rates.

Methods: County-level GDM rates per 100 deliveries were calculated for the 578 US counties with populations greater than 100,000 people (80% of US births) using a GDM indicator on 2019 birth certificates. Twenty demographic, health risk, neighborhood, healthcare, and socioeconomic variables were assessed using publicly available data from birth certificates, County Health Rankings & Roadmaps, American Community Survey, Social Vulnerability Index, and the U.S. Geological Survey. We included 567 counties with complete data in a multivariable linear regression model to test associations with GDM rates.

Results: County GDM rates ranged from 1.1 to 15.1 per 100 deliveries (IQR = 5.5–8.4 per 100 deliveries, median = 6.4, mean = 7.1). The 20 variables used in the model explain 21% of the variability in GDM prevalence. We found associations between county-level GDM and three demographic variables: mean maternal age ($\beta = 0.64$ [95% CI = 0.28, 0.99]), percent of births to non-Hispanic Asian mothers ($\beta = 0.08$ [0.03, 0.13]), and percent of births to non-Hispanic Black mothers ($\beta = -0.05$ [-0.07, -0.04]). Modifiable variables associated with county-level GDM were percent of adults with obesity ($\beta = 0.19$ [0.12, 0.25]), per capita income ($\beta = -0.0001$ [-0.0001, -0.00001]), number of primary care physicians per one million people ($\beta = 0.001$ [0.0001, 0.002]), White/racial minority segregation ($\beta = 0.02$ [0.001, 0.04]), arsenic present in USGS soil and stream samples ($\beta = 0.05$ [0.01, 0.09]), and unemployment rate ($\beta = 0.19$ [0.05, 0.33]).

Conclusions: Addressing structural and social determinants may help to reduce disparities in county-level GDM rates.

Authors: Ahlia Sekkarie, S. Park, N. Therrien, S. Jackson, R. Woodruff, S. Attipoe-Dorcoo, P. Yang, L. Sperling, F. Loustalot, A. Thompson-Paul

Background: Approximately one-third of U.S. adults have high low-density lipoprotein cholesterol (LDL-C) levels, increasing their risk of cardiovascular disease. In 2018, the American College of Cardiology and American Heart Association recommended use of maximally tolerated statin and add-on therapies (ezetimibe and/or PCSK9-inhibitors, FDA-approved in 2015) for hypercholesterolemia management. We estimated trends of statin and add-on therapy prescription fills by statin dosage intensity to determine if guidelines are followed.

Methods: By using the IQVIA Total Patient Tracker™ (TPT) database (covering ~93% of outpatient retail prescription fills in the U.S.) and the TPT concurrency tool, we estimated numbers of patients who received statins alone or with concurrent ezetimibe and/or PCSK9-inhibitors. Counts and percent change of prescriptions from Q3 2015–Q3 2021 were stratified by statin dosage intensity (i.e., low, moderate, or high for <30%, 30%–49%, and ≥50% LDL-C lowering, respectively).

Results: During the study period, prescription fills of low-intensity statins alone decreased 32% (3.7–2.5 million) and fills of moderate- and high-intensity statins alone increased 12% (17.0–19.1 million) and 86% (5.7–10.6 million), respectively. Ezetimibe was most frequently added to moderate-intensity statins from Q3 2015–Q4 2018, after which ezetimibe was most frequently added to high-intensity statins. By Q3 2021, concurrent prescription fills for PCSK9-inhibitor/statin were 2,300, 13,898, and 25,000 for low-, moderate-, and high-intensity statins, respectively. Ezetimibe/PCSK9-inhibitor/statin was the least prescribed combination, but increased to 537, 2,813, and 8,220 by Q3 2021 for low-, moderate-, and high-intensity statins, respectively. In Q2 2020 all prescription fills decreased, immediately followed by continued increases.

Conclusions: There was increased uptake of moderate- and high-intensity statins and add-on therapies for hypercholesterolemia management, despite a temporary disruption early during the COVID-19 pandemic. Provider education on hypercholesterolemia therapy prescriptions could reinforce adherence to recommended guidelines and help reduce cardiovascular disease risk.

CONCURRENT SESSION J1: Foodborne and Enteric Outbreaks

11:30 am–12:55 pm

Introduction: Robert Tauxe

Moderator: Jennifer Wright

11:35 Multipathogen Foodborne Outbreak Among Hospital Staff — Homer, Alaska, 2021

Authors: Katherine G. Newell, K. Helfrich, H. Isernhagen, L. Castrodale, J. McLaughlin

Background: On August 6, 2021, the Alaska Section of Epidemiology received notification of acute gastroenteritis among hospital staff after an August 5 takeout luncheon. We investigated to identify the outbreak source and prevent future illness.

Methods: We administered an online survey of food and illness histories to all hospital staff. Case-patients were respondents reporting new onset of gastroenteritis (diarrhea or abdominal cramping) during August 5–August 12, 2021. Control subjects were respondents without reported gastroenteritis. Associations between illness and consumption of different foods were measured using unmatched odds ratios (ORs). We reviewed food processing and handling procedures at the food vendor site. Leftover foods were collected and tested for enterotoxins.

Results: Of 515 hospital staff surveyed, 212 (41%) completed the survey; 66 (31%) met the case definition. Sixty-four (97%)

persons reported diarrhea and 62 (94%) reported abdominal cramps; none were hospitalized. Median incubation period from when lunch was served (noon, August 5 to symptom onset was 8.5 hours. Pork sandwiches consumed by 64 (97%) case-patients was associated with increased odds of illness (OR: 258; 95% CI: 57.2–1164.1). *Clostridium perfringens* and *Bacillus cereus* toxins were detected in 2 (100%) sandwich samples. The sandwiches were made for hospital staff by an off-site vendor and not sold publicly. No deficiencies were observed in food processing or handling at the vendor site; however, a hospital staff member collecting food on August 5 reported potential suboptimal temperature control of unknown duration at the vendor site while food awaited collection.

Conclusions: Epidemiologic and laboratory evidence indicate the outbreak was attributable to *C. perfringens* and *B. cereus* toxins in pork sandwiches. Both organisms are known to proliferate in food held at improper temperatures. We addressed temperature holding practices with the vendor to ensure future implementation of correct food safety measures.

11:55 Multistate Outbreak of *Salmonella* Oranienburg Infections Linked to Onions — United States, 2021

Authors: Christan H. Stager, B. Schneider, M. McClure, A. Wellman, S. Altman, S. Buuck, S. Cavallo, L. Cronquist, M. DeMarco, S. Flowers, M. Mannell, A. Morrison, D. Neises, C. Perez, J. Williams, Z. Ellison, L. Whitlock, Z. McCormick, L. Gieraltowski, K.P. Neil

Background: Non-typhoidal *Salmonella* causes an estimated 1 million foodborne illnesses annually in the United States. In September 2021, PulseNet detected a multistate outbreak of *Salmonella* Oranienburg infections. State and federal partners investigated to determine the source.

Methods: A case was defined as infection with the outbreak strain of *Salmonella* Oranienburg occurring on or after May 31, 2021. Patients were interviewed to determine common exposures. Food samples were tested for *Salmonella*. Common suppliers were identified by tracing foods of interest through distribution.

Results: As of December 1, 2021, 965 cases were reported from 38 states, Puerto Rico, and the District of Columbia. Twenty-five restaurants linked to illness subclusters were identified; 16 were Mexican-style. Testing identified the outbreak strain

in a mixed cilantro-lime sample from a take-out container collected from a patient's home; it previously contained raw onions, but none remained at time of testing. Overall, 279/364 (77%) patients interviewed with a focused questionnaire reported eating raw onions or foods likely to contain them, 169/340 (50%) reported cilantro, and 114/328 (35%) reported limes. Traceback conducted from 12 restaurants linked to illnesses revealed all received onions from two suppliers that were imported from the same state in Mexico. Traceback did not identify a common source of cilantro or limes. Both suppliers recalled implicated onions.

Conclusions: This large, multistate salmonellosis outbreak was linked to whole onions from Mexico. It illustrated the utility of using multiple types of data to investigate foodborne outbreaks. Exposure information alone did not solve this outbreak as multiple ingredients were commonly eaten together in Mexican-style dishes. Laboratory testing narrowed the focus, and epidemiologic and traceback data implicated imported onions as the source. This is the second large onion-associated outbreak in the United States in two years, highlighting the need for the onion industry and regulators to assess food safety gaps.

12:15 Shiga Toxin-Producing *Escherichia coli* Infection Outbreak Among Fair Attendees — Georgia, 2021

Authors: Jenna R. Gettings, H. Dishman, S. Wilson, M. Tobin-D'Angelo, A. Feldpausch, M. Hunter, A. Erickson, B. Johnson, J. Love, J. Gabel, C. Drenzek

Background: In November 2021, the Georgia Department of Public Health was notified of 10 Shiga toxin-producing *Escherichia coli* (STEC) infections among children who visited 2 fairgrounds (A and B) during October 2021. STEC infections cause gastrointestinal illness; 5%–10% of patients experience hemolytic uremic syndrome. STEC is carried by ruminants (e.g., cattle), and exposure occurs through contact with certain animals or contaminated food. Six isolates from affected patients were characterized as clonal O157:H7, indicating common exposure source. We investigated to identify exposure source and make control recommendations.

Methods: We surveyed Fairground B (>500,000 people) attendees to identify cases and measure associations between cases and fair exposures. We defined cases of STEC as diarrhea, bloody diarrhea, abdominal pain, or vomiting with onsets

during October 8–27 and 2–10-day incubation period from the earliest date of fair attendance among attendees; noncases were attendees with no symptoms. Relative risk (RR) and 95% CIs were estimated with log-binomial regression models. Animal registration records were compared between fairs.

Results: In total 1,347 attendees responded to the survey. We identified 200 cases and 948 noncases. Risk of being a case was 45% higher for attendees who visited cattle barns vs. those who did not visit cattle barns (RR: 1.45 [95% CI: 1.13–1.87]). Visits to other animals and barns were not significant. Record reviews confirmed that 45 cattle from Fairground A were also exhibited at Fairground B.

Conclusions: Cattle were the likely exposure source and linked to both fairgrounds. Touching cattle and associated environment was the likely transmission route. We recommended fairgrounds assess availability of educational signage and handwashing stations and ensure accessibility to all attendees.

12:35 *Salmonella* Mbandaka Outbreak on a College Campus – Maine, 2021

Authors: Parag Mahale, S. Bly, H. Grieser, S. Combes

Background: In April 2021, Maine Center for Disease Control and Prevention (MECDC) was notified of 10 college students with gastrointestinal symptoms <24 hours of eating at the college cafeteria, with unconfirmed reports of several additional ill students. MECDC initiated laboratory, epidemiologic, and environmental investigations to determine cause and extent of gastrointestinal illness.

Methods: Using culture and whole genome sequencing (WGS) Maine Health and Environmental Testing Laboratory tested stool samples from 8 ill students, and leftover cafeteria food. To identify additional ill students and ascertain exposures, we administered an electronic survey to students at the college. Case-patients were persons who met clinical criteria, i.e., ≥ 2 episodes of diarrhea and either nausea, abdominal pain, fever, or vomiting, with (confirmed) or without (probable) laboratory confirmation of *Salmonella* Mbandaka. Health inspectors used video call to virtually inspect the cafeteria and interview staff.

Results: Survey was completed by 129 ill students only. Eight symptomatic students had laboratory confirmed *Salmonella* Mbandaka infections and were classified as confirmed cases; WGS showed 0 allele difference, indicating a common source. In addition, we identified 121 probable case-patients. Among 100 food items assessed, the most commonly consumed food among case-patients were vegan pad thai (confirmed: 100%, probable: 75%) and peanut sauce (confirmed: 100%, probable: 67%) which were often served together. Staff interviews revealed rice noodles cooked 16 days previously were used for preparing pad thai despite smelling bad. Available leftover food tested negative for enteric bacteria; vegan pad thai was unavailable for testing.

Conclusions: Our investigation implicated vegan pad thai and peanut sauce in the *Salmonella* Mbandaka outbreak at the college. We recommend colleges more fully train cafeteria staff in safe food handling and preparation protocols. Despite limitations, electronic surveys can be effective case-finding tools in investigating gastrointestinal disease outbreaks at colleges.

CONCURRENT SESSION J2: Notes from the Field

11:30 am–12:55 pm

Introduction: Ryan Westergaard

Moderator: Stacey Bosch

11:35 SARS-CoV-2 Infections and COVID-19 Vaccine Coverage Among People Living with HIV – Chicago, Illinois, March 2020–December 2021

Authors: Richard A. Teran, J. Lauritsen, A. Gagner, S. Gretsche, D. Galanto, K. Walblay, S. Black, I. Tabidze

Background: People living with HIV (PLWH) may be at increased risk for poor COVID-19 outcomes. In Illinois, HIV infection, SARS-CoV-2 infection, and COVID-19 vaccination data are reported to separate information systems, encumbering COVID-19 outcome monitoring. We aimed to describe Chicago's population of PLWH with confirmed or probable SARS-CoV-2 infection and evaluate COVID-19 vaccine coverage.

Methods: Data from the Enhanced HIV/AIDS Reporting System were matched using a 12-key deterministic match to COVID-19 cases reported to Illinois' disease surveillance system and vaccination records in Illinois' immunization registry. Characteristics between PLWH with COVID-19 and non-PLWH with COVID-19 were compared using Pearson's Chi-squared and Wilcoxon signed tests.

Results: Among 20,025 PLWH living in Chicago, 1,990 (10%) had at least one positive SARS-CoV-2 antigen or nucleic acid amplification test result; of these 40 (2%) had

possible reinfection, 356 (18%) were hospitalized, and 59 (3%) experienced a COVID-19-related death. Compared with all COVID-19-related deaths among Chicagoans, PLWH who died from COVID-19 were younger (median age 60 vs. 72 years), and a higher proportion were male (73% vs. 58%) and non-Hispanic or Latino Black (59% vs. 41%); all $P < 0.05$. Over half (65%; 12,765/19,645 persons alive on 12/1/2020) of PLWH received at least one dose of COVID-19 vaccine; 11,881 (60%) completed a vaccine series; and 4,846 (25%) received a booster. A total of 223 (2%; 223/11,723) SARS-CoV-2 infections occurred among fully vaccinated PLWH; 20 SARS-CoV-2 infections occurred after a booster dose.

Conclusions: State and local health jurisdictions can monitor COVID-19 outcomes and vaccination among PLWH by integrating data across public health information systems. In Chicago, we found sociodemographic differences across COVID-19 outcomes, and suboptimal vaccination coverage among PLWH. COVID-19 vaccines are recommended for all PLWH, regardless of CD4 count or HIV viral load, including booster vaccines. Merging public health information systems can help local jurisdictions target vaccination efforts.

11:55 COVID-19 Outbreak Surveillance — Vermont: March 25, 2020–September 23, 2021

Authors: Brian F. Borah, J. Pringle, J. Brennan, P. Kelso, G. Mertes, J. Ulmer, P. Meddaugh, V. Fialkowski, N. Kwit

Background: Outbreak data can guide public health decisions. Outbreaks are reportable in Vermont, and COVID-19 outbreaks are actively and passively surveilled by Vermont Department of Health (VDH). We compared COVID-19 outbreak characteristics and outcomes across settings to prioritize public health interventions.

Methods: We reviewed COVID-19 outbreak data recorded by VDH during March 25, 2020–September 23, 2021. COVID-19 outbreaks were defined as ≥ 2 epidemiologically linked confirmed or probable cases (per national case definitions) with illness onsets or positive specimen collections within 14 days; on March 28, 2021, the definition changed to ≥ 3 cases to increase specificity. Outbreaks were considered resolved when no new cases were identified ≤ 28 days of last known exposure; duration was first case illness onset or positive test collection date until outbreak resolution date.

Results: Of 619 outbreaks, 270 (44%) were in workplaces or businesses, 113 (18%) in K-12 schools, 78 (13%) in residential health facilities, 74 (12%) in community settings, 57 (9%) in child care facilities, 13 (2%) in colleges or universities, 7 (1%) in prisons, and 7 (1%) in homeless shelters. Median size was 5 cases/outbreak (range: 2–796 cases); median duration was 38 days (range: 28–161 days). While infrequent, prison outbreaks were largest and longest, with a median of 33 cases (range: 6–203) and 65 days (range: 41–79) per outbreak. Among all state COVID-19 cases, outbreaks were associated with 19% (6,186/32,436) of cases, 14% (128/930) of hospitalizations, and 57% (191/335) of deaths. Most outbreak-associated hospitalizations (62/128; 48%) and deaths (167/191; 87%) occurred in residential health facilities

Conclusions: The largest and longest outbreaks occurred in prisons. Of all state COVID-19 deaths, most were associated with outbreaks; nearly half occurred in residential health facility outbreaks. In Vermont, outbreak surveillance and public health responses in prisons and residential health facilities should be prioritized.

12:15 Regional Cluster of Legionella: Look to the Laboratory — South Carolina, 2021

Authors: Marco Tori, R. Radcliffe, T. Bradford, K. Butts, A. Blackwell

Background: *Legionella* infections have increased 10-fold in the United States during the previous 20 years because of multiple factors that may include diagnostic testing changes. Public health staff routinely investigate case clusters; however, *Legionella* outbreak sources are difficult to identify. During June–August 2021, reported *Legionella* cases increased 125% in 1 South Carolina region, compared with years prior. We investigated to determine potential outbreak sources and if introduction of a new urinary antigen test (UAT) at the regional hospital performing patient testing was a contributing factor.

Methods: We included patients identified during June 1–August 5, 2021, meeting the confirmed Legionnaires' disease case definition. We interviewed patients or surrogates during August 16–18, analyzing demographics and potential exposures 14 days before illness onset. We interviewed the regional hospital laboratory director about *Legionella* test methods and obtained laboratory testing data for 2021 to calculate monthly percent positivity of the hospital's *Legionella* UAT.

Results: We identified a 21-patient cluster (aged 4–90 years; median: 64 years); all 21 tested positive by UAT through the regional hospital laboratory. We interviewed 15 patients or surrogates (71%); we did not identify a common exposure or point source. Reported *Legionella* cases increased after the regional hospital began using the Hardy Diagnostics UAT assay in May and returned to baseline after the laboratory began repeating UAT in positive samples in August. UAT percent positivity was 0.3% (2/680) during March–April, 2.2% (14/634) during June–July, and 0.3% (3/1195) during September–October.

Conclusions: Because epidemiologic data did not identify a possible source and reported cases decreased without public health intervention, changes to the regional hospital's UAT may have contributed to increased case identification. Because *Legionella* outbreak investigations are time- and resource-intensive for public health staff, verifying diagnosis may prevent undue resources from being expended.

Authors: Caroline Q. Pratt, T. Shragai, J. Castro Georgi, M. Donnelly, N. Schwartz, A. Matanock, V. Chu, R. Soto, M. Chuey, B. Austin, M. Beatty, B. Albanese, M. Hudzic, G. Stringer, E. Totten, L. Hughes-Baker, O. Herzegh, J. Vinje, N. Thornburg, H. Kirking, J. Tate, C. Hsu

Background: Though transmission risk of SARS-CoV-2 from contaminated surfaces is considered low, its significance in households is not clear. We collected environmental swabs in households with one or more positive SARS-CoV-2 cases to understand fomite transmission risks.

Methods: CDC partnered with San Diego County, California and metropolitan Denver, Colorado health departments to enroll households from January–April 2021. Information on demographics, symptoms, exposures, and mitigation behaviors were collected. Ten environmental swabs were collected at enrollment from each household. Surfaces swabbed included pillows, nightstands, bathroom surfaces, refrigerator door handles, light switches, high traffic areas, and high touch objects. Quantitative reverse transcription polymerase chain reaction (RT-qPCR) was conducted on swabs; those with cycle threshold (Ct) values <28 were assessed for culturable virus. Frequency of surface types positive for SARS-CoV-2 by RT-qPCR and viral culture, and bivariate associations between

household characteristics, behaviors, and RT-qPCR positive surfaces using ANOVA and linear regression were reported.

Results: Of 1232 samples from 124 households, 27.7% (n = 342) were RT-qPCR positive, and 0.2% (n = 3 samples from one household) were viral culture positive. Nightstands (44.1% positive) and pillows (40.9%) were most frequently positive by RT-qPCR. Households with more infected individuals ($P < 0.0001$), symptomatic individuals ($P = 0.004$), and individuals experiencing cough, rhinorrhea/congestion, or diarrhea ($P = 0.003$, $P = 0.005$, $P = 0.002$) were associated with RT-qPCR positivity. The number of RT-qPCR positive samples was also higher from homes with documented household transmission ($P < 0.0001$), infected with non-Alpha lineages ($P = 0.002$), and with infected children ($P = 0.01$).

Conclusions: Shedding of SARS-CoV-2 RNA by infected persons onto surfaces is common, as evidenced by high proportions of RT-qPCR positive surfaces. Few samples, however, were positive by viral culture, suggesting fomite transmission in households is low. High RT-qPCR positivity on nightstands and pillows of positive household members may reflect time spent sleeping unmasked and supports isolation of infected household members.

CONCURRENT SESSION J3: Tuberculosis

11:30 am–12:55 pm

Introduction: Deron Burton

Moderator: Laura Cooley

11:35 Tuberculosis Among Native Hawaiian and Pacific Islander Persons — United States and U.S.-Affiliated Pacific Islands, 2010–2019

Authors: Molly Deutsch-Feldman, D. Felix, Y. Springer, C. Tsang, R. Brostrom, M. Haddad

Background: Overall tuberculosis (TB) incidence has declined in the United States but increased among Native Hawaiian and Pacific Islander (NH/PI) persons, a group associated with numerous health disparities. Detailed information on the epidemiology of TB among NH/PI persons, particularly in the U.S.-Affiliated Pacific Islands (USAPI), is lacking. To further TB prevention efforts, we sought to describe TB incidence and risk factors among NH/PI persons during 2010–2019.

Methods: We used data from the National Tuberculosis Surveillance System to characterize TB cases reported among NH/PI persons in the 50 U.S. states, the District of Columbia (DC), and the USAPI. Population denominator data for incidence calculations came from the U.S. Census Current Population Survey, the International Data Base, and the United Nations. Using non-U.S.-born Asian persons, another high TB incidence group, as the reference, we calculated the prevalence ratio (PR) for reported TB risk factors, stratified by area of residence.

Results: During 2010–2019, 4,700 TB cases were reported among NH/PI persons, including 902 living in a U.S. state or DC and 3,798 in the USAPI. Mean annual TB incidence was 9.8 per 100,000 persons and 97.0 per 100,000 persons, respectively. The highest incidence was in the Republic of the Marshall Islands (333.1 per 100,000). Regardless of location, NH/PI TB patients had a higher proportion of cases attributed to recent transmission (PR in U.S. states: 3.9 [95% CI: 3.3–4.6]; PR in USAPI: 9.7 [95% CI: 9.1–10.4]) and higher diabetes prevalence (U.S. states PR: 1.4 [95% CI: 1.2–1.5]; USAPI PR: 1.1 [95% CI: 1.1–1.2]) than non-U.S.-born Asian TB patients.

Conclusions: TB incidence among NH/PI persons is relatively high, particularly in the USAPI, indicating a need to enhance TB prevention strategies in these communities. Interventions should be tailored toward those at highest risk, including NH/PI persons with diabetes.

11:55

Unusual Tuberculosis Cluster with High Attack Rates After Spinal Surgery with a Contaminated Tissue Product — Delaware, 2021

Authors: W. Wyatt Wilson, R. Li, N. Schwartz, A. Hernandez-Romieu, J. Glowicz, T. Filardo, M. Deutsch-Feldman, E. Hanlin, M. Taylor, H. Pelkey, C. Briody, L. Gireesh, M. Eskander, K. Lingenfelter, S. Althomsons, R. Stewart, R. Free, P. Annambhotla, S. Basavaraju, J. Wortham, S. Bamrah Morris, I. Benowitz, M. Haddad, R. Hong, M. Drees

Background: On May 25, a Delaware hospital notified health authorities of 7 patients who developed tuberculosis after spinal surgery with a bone tissue material from a single donor product lot. A CDC team deployed to examine opportunities for product contamination with *M. tuberculosis* (*Mtb*), describe patients, and provide treatment recommendations.

Methods: We examined product handling and infection prevention and control (IPC) practices from product delivery at the hospital until implantation. We abstracted clinical, laboratory, and imaging data to characterize tuberculosis disease among product lot recipients. We issued a national call for cases, defined as a person with imaging or laboratory evidence of tuberculosis after orthopedic surgery since January 1, 2021.

Results: We identified no product handling or IPC gaps suggesting local *Mtb* contamination. Overall, there were 21 cases among 23 (91%) product lot recipients in Delaware. All recipients received spinal imaging, and 21 (91%) had evidence of infection, including abscesses (n = 19; 83%) and osteomyelitis or discitis (n = 17; 74%). Among 21 recipients with vertebral, paraspinal, or sputum specimen testing, 17 (81%) had laboratory-confirmed tuberculosis disease. One patient died. Among 22 living recipients with sputum testing or chest imaging, 6 (27%) demonstrated evidence of pulmonary tuberculosis. On June 2, another state notified CDC of another recipient with tuberculosis following surgery with the same product lot, and the manufacturer issued a voluntary nationwide recall. On June 4, we recommended recipients of the recalled lot initiate standard treatment for tuberculosis disease, even if asymptomatic; all 22 living recipients began treatment 41–91 days after surgery (median: 69 days).

Conclusions: Surgery involving a contaminated bone tissue product distributed nationwide led to high attack rates of tuberculosis, prompting a national recall and urgent treatment recommendations. The hospital's early recognition of an unusual *Mtb* transmission route enabled a rapid national public health response.

12:15

Unusual Healthcare Personnel Exposures to *Mycobacterium tuberculosis* Related to a Contaminated Surgical Product — United States, 2021

Authors: Ruoran Li, M. Deutsch-Feldman, A. Hernandez-Romieu, T. Filardo, N. Schwartz, W. Wilson, S. Althomsons, J. Wortham, S. Bamrah Morris, I. Benowitz, M. Haddad, J. Glowicz

Background: During March–June 2021, 113 patients in 35 surgical facilities underwent surgeries involving bone grafts contaminated with *Mycobacterium tuberculosis* (*Mtb*), resulting in a large outbreak with high attack rates of pulmonary and extrapulmonary tuberculosis disease among recipients. We described potential *Mtb* exposures among healthcare personnel (HCP) to guide contact investigation nationally.

Methods: In June–July 2021, we assessed patient-care practices at 3 hospitals in 2 states to identify potentially exposed HCP. We defined exposed HCP as those (a) present during graft implantation or other activities that could aerosolize *Mtb* or (b) who had contact with patients with draining tuberculous lesions or pulmonary tuberculosis in the absence of Airborne Precautions. We shared exposure assessment guidance with tuberculosis control programs and affected facilities and collected data summarizing HCP roles, exposures, and *Mtb* infection testing results.

Results: Onsite assessments identified unusual *Mtb* exposures including handling bone grafts, emptying wound drains, and other care activities for patients with draining extrapulmonary tuberculous lesions in the absence of Airborne Precautions. As of December 3, 29 healthcare facilities had reported their preliminary contact investigations. Among 4,511 HCP identified as potentially exposed, 2,907 (64%) were screened for *Mtb* infection, and 52 (2%) tested positive, including 10 (19%) who worked in perioperative departments, 3 (6%) in environmental services, 4 (8%) in sterile processing departments, 16 (31%) in inpatient units, long-term care, or outpatient facilities, and 19 (37%) in unidentified roles (data collection ongoing to determine if infections were new or prevalent).

Conclusions: This investigation identified infections among HCP and unusual *Mtb* exposures across several patient-care roles; these infections cannot definitively be attributed to any specific exposure. In situations where novel exposures are implicated, collaboration between public health authorities and healthcare facilities is essential for implementing appropriate infection control measures and guiding effective contact investigations.

12:35 Effects of Racial/Ethnic Disaggregation on the Characterization of Tuberculosis Epidemiology Among American Indian and Alaska Native Persons

Authors: Thomas D. Filardo, Y. Springer, R. Woodruff, J. Self

Background: Current methods of characterizing tuberculosis (TB) epidemiology based on U.S. Office of Management and Budget (OMB) standards use single-race, non-Hispanic race/ethnicity groups, yet more than half of American Indian and Alaska Native (AIAN) persons in the United States self-identify as multiracial or Hispanic. We investigated the effects of racial/ethnic disaggregation on the characterization of TB epidemiology among AIAN persons.

Methods: Using data from the National Tuberculosis Surveillance System (2003–2019), we compared TB among persons who identified as single-race, non-Hispanic AIAN ([AIAN-OMB], $n = 2,218$), multiracial or Hispanic AIAN ([AIAN-MH], $n = 508$), any AIAN ([AIAN-all], $n = 2,726$), and single-race, non-Hispanic White ([White-OMB], $n = 29,681$). We calculated annual incidence rates ([IRs], cases per 100,000 persons) and incidence rate ratios (IRRs) using American Community Survey 5-year population estimates and risk ratios (RRs) for TB risk factors; associated 95% CIs were calculated using the Wald method.

Results: Crude annual IRs for AIAN-all persons (median: 3.01; range: 2.02–4.05) were lower than for AIAN-OMB persons (median: 5.59; range: 3.76–7.47). Compared with White-OMB persons, annual IRRs among AIAN-all persons (median: 4.09; range: 3.51–5.01) were lower than among AIAN-OMB persons (median: 8.40; range: 5.49–11.10). Compared with AIAN-OMB persons, AIAN-MH persons had significantly lower risk of having a previous case of TB reported (RR: 0.5; 95% CI: 0.32–0.78) and experiencing homelessness in the year prior to diagnosis (RR: 0.49; 95% CI: 0.36–0.67), and higher risk of being incarcerated at diagnosis (RR: 1.66; 95% CI: 1.09–2.53).

Conclusions: Inclusion of all AIAN persons significantly affected TB incidence estimates. Disaggregation of AIAN persons also revealed significant differences in TB risk factors among race/ethnicity subgroups. Exclusion of subgroups, such as persons with multiple races/ethnicities, can significantly impact estimates of racial/ethnic health disparities.

CONCURRENT SESSION K1: Global Pandemic Response and Impacts

1:25–2:50 pm

Introduction: Emily Kainne Dokubo

Moderator: Amy Schumacher

1:30 Impact of the COVID-19 Pandemic on Global Routine Vaccination Coverage in 2020

Authors: Pierre Muhoza, M. Danovaro-Holliday, M. Diallo, P. Murphy, S. Sodha, J. Requejo, A. Wallace

Background: Progress in global routine vaccination coverage is estimated to have helped avert at least 37 million deaths between 2000 and 2019 in low- and middle-income countries. The COVID-19 pandemic has affected health services worldwide, including childhood routine vaccinations (e.g., diphtheria-tetanus-pertussis [DTP], measles, and polio [Pol] vaccines). We assessed global, regional, and national routine vaccination coverage in 2020 and compared it to pre-pandemic years.

Methods: We analyzed World Health Organization (WHO)/UNICEF estimates of national immunization coverage (WUENIC) derived from country-reported administrative and household survey data, which included coverage data from 1980 onward for WHO and UNICEF member countries and regions. For each vaccine and geographic area, annual coverage was estimated as the percent target population vaccinated.

Results: Global estimates of coverage with the three recommended doses of DTP (DTP3) and polio (Pol3) vaccines

decreased from 86% in 2019 to 83% in 2020. Similarly, coverage with the first dose of measles-containing vaccine (MCV1) dropped from 86% in 2019 to 84% in 2020. The last year that coverage estimates were at 2020 levels was 2009 for DTP3 and 2014 for both MCV1 and Pol3. The Western Pacific Region was the only region with unchanged DTP3 coverage estimates from 2019 to 2020, whereas all others experienced decreases. In 2020, approximately 17.1 million children worldwide did not receive any DTP vaccine (zero-dose children), an increase of 3.5 million from 2019. Approximately 65% of the zero-dose children lived in just 10 countries.

Conclusions: Decreases in routine childhood vaccination coverage were widespread in 2020, likely related to the disruptive effects of the COVID-19 pandemic. Addressing the immunity gaps caused by the disruptions will require targeted, context-specific strategies to identify and catch up zero-dose and undervaccinated children. Immunization programs also need to introduce or strengthen interventions to minimize missed vaccinations, monitor coverage, and respond to program setbacks.

1:50 Disruptions to Essential Health Services in Kenya and Cameroon During the COVID-19 Pandemic — February 2020–October 2021

Authors: Matthew J. Hudson, G. Woelk, C. Herzig, R. Machezano, R. Masaba, B. Tchounga, B. Park, E. Bancroft

Background: The COVID-19 pandemic disrupted essential health services (EHS) delivery worldwide; however, there are limited data for healthcare facility (HCF) level EHS disruptions in low- and middle-income countries. We surveyed HCF in Kenya and Cameroon to understand the extent of and reasons for EHS disruptions occurring during February 2020–October 2021.

Methods: In both Kenya and Cameroon, three counties with high burden of COVID-19 were included. Stratified sampling of HCFs occurred by HCF level. HCF administrators were interviewed to collect information on types of EHS disruptions that occurred and reasons for disruptions, including those related to infection prevention and control (IPC). Analyses included descriptive statistics with proportions for categorical variables.

Results: 59 HCFs in Kenya and 59 HCFs in Cameroon provided complete data. Most HCFs reported EHS disruptions due to COVID-19 (Kenya, n = 59/59, 100%; Cameroon,

n = 51/59, 86%). Among all HCFs (n = 59 in each country), limiting patient volumes was the most common disruption reported (Kenya, 97%; Cameroon, 75%). In Kenya, 56% of HCFs reduced staffing of EHS and 52% suspended EHS; in Cameroon, 32% and 17% of HCFs reported these disruptions, respectively. Among HCF that reported disruptions, the most cited reason in both countries was fewer patients attending services (Kenya, 95%; Cameroon, 31%). The most common IPC-related reason for disruption was diversion of resources to accommodate physical distancing measures (Kenya, 76%; Cameroon, 37%) followed by COVID-19 outbreaks among patients or staff (Kenya, 34%; Cameroon, 41%); staff shortages due to COVID-19 illness (Kenya, 25%; Cameroon, 31%) or perceived infection risk (Kenya, 19%; Cameroon, 12%); and lack of adequate personal protective equipment (Kenya, 20%; Cameroon, 24%).

Conclusions: Most HCF reported disruptions to EHS during the pandemic, including many that were IPC-related. Some disruptions may be mitigated by strengthening IPC infrastructure and practices, including protecting healthcare personnel to prevent staffing shortages.

2:10 Using Nigeria's COVID-19 Vaccination Data to Identify Vaccine Rollout Challenges

Authors: Talya Shragai, H. Ikwe, J. Adegoke, A. Asekun, O. Bolu

Background: As of November 2021, 51% of the world's population have received at least one COVID-19 vaccine dose but just 2.8% of doses administered have been in Africa. Inequitable vaccine supply is often cited for this imbalance; however, multiple countries have struggled to administer donated doses before expiration due to other challenges. Nigeria, a lower-middle income west African country, has received 29 million (M) doses of COVID-19 vaccine doses for their 206M population. Here we use Nigeria's vaccination data to quantify challenges administering COVID-19 vaccines.

Methods: From August 16 to November 2, 2021, data on vaccines administered were collected daily by vaccination sites through a paper-based system and aggregated nationally into an excel database. Variables were calculated including wastage (% discarded/distributed), and site operability (% of days sites were open) and accessibility (vaccination sites/100,000 population). Descriptive summary statistics including rates, median, and range were calculated for all variables nationally

and disaggregated by state, local government area (LGA), and vaccine brand (AstraZeneca or Moderna).

Results: Overall, 5.1% (5.7/111M) of adult Nigerians (>18 years) were at least partially vaccinated, of which 55% (3.1M) were fully vaccinated. Vaccine wastage ranged between 0%-54% by LGA and vaccine brand; Moderna wastage (median 7.8%) was consistently higher than AstraZeneca (median 0.0%). Accessibility and operability varied by LGA with a median of 3 vaccination site teams listed per 100,000 population (range 0.5–10.0) and a median of 23.9% (range: 0.0–86.6%) of days with no doses administered.

Conclusions: COVID-19 vaccine supply was not the only barrier to rollout in Nigeria. Identified challenges included wastage, low demand, limited second-dose administration, and inconsistent accessibility and operability of sites, with high geographic variation for all measures. Quantifying the extent of these challenges by location informs interventions to expand administration. Qualitative approaches to better understand the barriers will help further address vaccination inequity.

Authors: Katrin S. Sadigh, Z. Gilani, T. Yeabah, M. Dahlke, J. Gidudu, M. Kromah, M. Baysah, A. Clarke, T. Kanter, R. Idowu

Background: Prompt identification, reporting, and investigation of adverse events following immunization (AEFI) are important to maintain public confidence in vaccination programs. In Liberia, AEFI case reports are referred by surveillance officers and clinicians to a causality assessment committee for evaluation. We rapidly assessed the AEFI surveillance and response system in Liberia to develop recommendations for system strengthening in the context of expanding COVID-19 vaccination.

Methods: The National AEFI Surveillance System Gap Identification questionnaire, a standardized assessment tool covering broad categories, including human resources, AEFI reporting and investigation, and causality assessment, was administered to three Liberia Ministry of Health (MOH) personnel and consultants in September 2021 targeting COVID-19 vaccines. A full day national AEFI data harmonization meeting and one causality assessment committee meeting were observed for adherence to published

World Health Organization (WHO) guidance. Key informants from the MOH, national regulatory authority, WHO, and CDC-Liberia country office, were identified and interviewed.

Results: As of September 8, 2021, a total of 58,481 adults had been vaccinated with either the Janssen or AstraZeneca COVID-19 vaccines, and 115 AEFI, including two serious AEFI, were reported to the MOH. Staffing and reporting mechanisms were effective at most levels, including national, county, district, and health facility but limited at the community level. All AEFIs reported were investigated, though causality was frequently deemed inconclusive because of lack of clinical information. Several electronic data systems exist for AEFI reporting, although no system fulfills all needs with limited interoperability between systems.

Conclusions: The AEFI surveillance and response system in Liberia allows for investigation of all reported serious AEFI, however causality assessment determination is incomplete. The system could be strengthened by augmenting community level staffing and reporting through involvement of community health assistants; optimizing the role of clinicians in acquiring clinical data; and improving the efficiency of electronic data systems.

CONCURRENT SESSION K2: Vector-Borne Diseases

1:25–2:50 pm

Introduction: Lyle Petersen

Moderator: Suzanne Beavers

1:30 Increase in Colorado Tick Fever Cases — Montana, 2020

Authors: Raymond A. Soto, E. Baldry, G. Vahey, J. Lehman, M. Silver, A. Panella, H. Hughes, K. Fitzpatrick, J. Velez, A. Brault, B. Biggerstaff, B. Wolff, L. Ruth, E. Staples, C. Gould

Background: Colorado tick fever (CTF) virus is transmitted to humans by *Dermacentor andersoni* ticks and causes a febrile illness. In 2020, 21 CTF cases were reported in Montana, compared with ≤ 1 CTF case/year previously. We used a multifaceted approach to investigate causes of the increase.

Methods: We reviewed CTF testing practices and calculated percent positivity. We conducted a case-control study of Montana residents who tested positive or negative for CTF during 2020 to assess risk factor differences. We surveyed Montana healthcare providers' CTF awareness and testing practices.

Results: Because of SARS-CoV-2 testing during 2020, the state laboratory sent specimens to CDC for CTF virus RNA and antibody detection (positivity: 21/148 [14.2%]). Before this, the state laboratory performed CTF testing using an antibody assay (average annual positivity: 2.3/156 [1.4%]). We interviewed

14 (67%) of 21 case-patients and 22 (26%) of 86 control-patients. Almost half of case-patients (43%; 6/14) and control-patients (45%; 10/22) spent more time outside in 2020 compared with 2019. Before illness onset, 86% of case-patients spent ≥ 4 hours outside/weekend day vs. 52% of control-patients (difference: 33.3; 95% CI: 0.8–58.0). All case-patients found a tick on themselves vs. 41% of control-patients (difference: 59.1; 95% CI: 33.3–76.9); most ticks were acquired in National Parks. Among case-patients who knew where they acquired their tick, 46% (6/13) were in Ravalli county, slightly higher than control-patients (33%; 3/9). No significant changes in provider awareness and testing for CTF in 2020 were found.

Conclusions: COVID-19-related changes in testing protocols led to the large increase in CTF cases being identified in Montana in 2020. CDC worked with state health department and U.S. Forest Service partners to target tick prevention messaging to high-risk areas identified and will work with the state laboratory to incorporate more sensitive molecular methods into their CTF testing protocol.

Authors: Anna C. Fagre, R. Soto, R. Magleby, M. Cuaderna, A. Sun, K. Cervantes, S. Crans, K. Horiuchi, B.J. Biggerstaff, E. Staples, R. Connolly, S.W. Martin, N. Komar

Background: Eastern equine encephalitis virus (EEEV), a mosquito-borne alphavirus, is endemic to eastern and Gulf Coast states. It is the cause of the most severe domestic arboviral encephalitides in the United States. Since 1975, New Jersey has conducted EEEV surveillance using heavy wooden resting boxes (RBs) to monitor the primary vector, *Culiseta melanura*, to inform mosquito control measures. We assessed whether newer and more versatile trap types are more effective at capturing *Cs. melanura*.

Methods: In September, we implemented a 4-treatment, 4-period cross-over study in Camden County, New Jersey to evaluate 4 trap types: 1) traditional wooden RBs, 2) CDC resting traps (RT) from BioQuip Products, 3) corrugated plastic (CP) boxes from Flexcon®, and 4) wood fiber planters (FP). During 4 consecutive nights, 12 traps of each type were placed in a grid using a predetermined random sequence.

Mosquitoes were collected each morning and sorted by species, sex, and bloodfed status, a marker of reproductive capability. Analyses were performed on all female and bloodfed female *Cs. melanura*. Pairwise comparison of mean ratios (MR) for *Cs. melanura* collected per trap night and 95% CI were calculated using Poisson regression adjusting for trap location, period, and multiple comparisons.

Results: CPs and RBs were equally effective at trapping all female *Cs. melanura* (MR: 1.5; 95% CI: 0.84–1.55) and were more effective than FPs or RTs. However, CPs trapped more bloodfed *Cs. melanura* compared to all other trap types, including RBs (MR: 2.33; 95% CI: 1.31–4.59).

Conclusions: CPs were more successful in trapping bloodfed *Cs. melanura* and provide a more maneuverable, lightweight alternative to traditional wooden RBs for detection of female *Cs. melanura*. Optimizing trap types can improve vector monitoring and EEEV detection, serving as an early warning system to guide vector control measures.

Authors: Joshua M. Wong, H. Volkman, L. Adams, C. Oliveras García, A. Martínez-Quíñones, J. Pérez-Padilla, J. Bertrán-Pasarell, D. Sainz de la Peña, R. Tosado-Acevedo, G. Santiago, J. Muñoz-Jordán, B. Torres-Velásquez, O. Lorenzi, L. Sánchez-González, V. Rivera-Amill, G. Paz-Bailey

Background: Dengue and influenza are pathogens of global concern and can cause acute febrile illness similar to COVID-19, making diagnosis challenging for healthcare providers. We analyzed data from an enhanced surveillance system operating from three emergency departments and an urgent care clinic in Puerto Rico to identify clinical features predictive of influenza or dengue compared to COVID-19.

Methods: We included participants presenting with fever or respiratory symptoms and aged ≥ 18 years enrolled from May 2012–January 2021 with dengue, influenza, or SARS-CoV-2 confirmed by reverse transcriptase polymerase chain reaction. We calculated adjusted odds ratios (aOR) and 95% CIs using logistic regression to assess clinical characteristics of participants with COVID-19 compared to dengue or influenza, adjusting for age, region, and days from illness onset to presentation.

Results: Among 13,431 participants, we identified 2,643 participants with dengue ($n = 303$), influenza ($n = 2,064$), or COVID-19 ($n = 276$). We found differences in the days from illness onset to presentation among influenza (2 days [interquartile range: 1–3]), dengue (3 days [2–4]), and COVID-19 cases (4 days [2–7]; $P < .001$). Using COVID-19 as the reference group, we found that cough (aOR: 0.12 [95% CI: 0.07–0.19]) and shortness of breath (0.18 [0.08–0.44]) were less common in dengue compared to COVID-19. Facial flushing (20.6 [9.8–43.5]) and thrombocytopenia (24.4 [13.3–45.0]) were more common in dengue. Runny nose was more common in influenza compared to COVID-19 (8.3 [5.8–12.1]).

Conclusions: Cough, shortness of breath, facial flushing, and thrombocytopenia can help distinguish between dengue and COVID-19 at presentation. Although few features distinguish influenza from COVID-19, patient presentation >4 days after symptom onset suggests COVID-19. These findings may assist healthcare providers make time-sensitive decisions related to triage, isolation, and management while pursuing pathogen-specific testing.

Authors: Amy M. Beeson, E. Baldry, K. Broussard, S. Ladd-Wilson, B. Mayes, N. Marzec, H. Rettler, I. Ruberto, H. Schnitzler, L. Tengelsen, H. Venkat, A. Hinckley, G. Marx

Background: Tick-borne relapsing fever (TBRF) is a rare illness caused by *Borrelia* spirochetes and characterized by relapsing episodes of high fever, headache, and myalgia. Without prompt effective antibiotics, severe disease or death can occur. The pathogen is transmitted by *Ornithodoros* ticks, which can live for decades in rustic cabins or caves where they feed on reservoir rodents. Case detection facilitates timely public health investigation and environmental mitigation, which are essential to preventing additional infections; however, TBRF surveillance practices have not been previously described.

Methods: We conducted semi-structured phone or video interviews with key state health department personnel in 14 Western states where TBRF is endemic. Topics included current practices and specific challenges in TBRF surveillance. We then abstracted interview notes to identify common themes.

Results: Personnel in all 14 states participated. Thirteen (93%) confirmed that TBRF is currently reportable in their state with

most cases identified through electronic laboratory reporting. Only 7 of 13 states (54%) use a formal case definition, which varies by state; 6 of 13 (46%) states reported performing on-site environmental investigations when resources allowed. All participants expressed concerns about the adequacy of surveillance; only 1 of 14 (7%) believed that reported cases accurately reflect trends in incidence. Specific challenges emerged as themes: widespread under-recognition and under-reporting by providers; inadequate testing capacity and knowledge of testing protocols; and competing priorities during the COVID-19 pandemic resulting in incomplete case follow-up and response.

Conclusions: TBRF surveillance in the United States is currently characterized by inconsistent reporting, case definitions, testing availability, and resource availability for investigations, leading to missed opportunities for detection and prevention. Surveillance efforts might be strengthened by a coordinated effort to improve clinicians' knowledge of this under-recognized disease, a standardized national case definition, and dedicated resources for testing and case investigation in targeted jurisdictions.

CONCURRENT SESSION K3: Waterborne Diseases

1:25–2:50 pm

Introduction: Michael Beach

Moderator: Michael Cherry

1:30 *Mycobacterium abscessus* in the Cerebrospinal Fluid of Two Hospitalized Patients — Maryland, 2021

Authors: Molly A. Kreuze, M. Duwell, D. Blythe, D. Crum, J. Rubin, R. Oatis, B. Burall Jr, L. Berry

Background: A Maryland hospital cultured *Mycobacterium abscessus* from cerebrospinal fluid (CSF) of 2 patients over a 4-day period. *M. abscessus* is a rapidly growing, multidrug-resistant species of non-tuberculosis mycobacteria (NTM) commonly found in water; NTM form biofilms of various NTM strains and species. While *M. abscessus* commonly causes lung and skin infections, CSF infections have not been widely reported. This investigation sought to determine the source of this outbreak.

Methods: Health officials reviewed medical records, hospital protocols, and water management plans, and conducted an infection prevention (IP) site visit. The Wadsworth Center conducted whole-genome sequencing (WGS) on clinical samples. Maryland's public health laboratory cultured water samples from each patient's room sink, main backflow preventer, and facility point-of-entry.

Results: Although both patients had external ventricular drains (EVDs), few other similarities were noted, including different hospital units, different disease processes, and minimal staff overlap. No concerns were identified with hospital protocols. However, NTM were not addressed in the facility's water management plan. An IP site visit revealed glove boxes behind patient room sinks with the splash zone. WGS revealed patients' strains were unrelated. Water culture from 1 sink identified 2 NTM species; *M. mucogenicum* and *M. avium*. Additional site culture results are pending.

Conclusions: Unrelated *M. abscessus* strains were cultured from CSF of 2 patients. The source of these infections is unknown. However, because building water cultured additional NTM species, exposure to this contaminated water is possible. Different strains and species do not preclude a common source because NTM biofilms are a variable milieu. NTM in sink water indicates favorable growing conditions, which might be found in other parts of the water system. Remediation might include universal water sampling, point-of-use filters, and hyperchlorination. This information could help health care facilities update their water management plans to include pathogens other than *Legionella pneumophila*.

1:50

Non-pneumophila Legionella at an Adult Basketball Camp — North Carolina, 2021

Authors: Erin K. Ricketts, J. MacFarquhar, W. Glover, C. Goforth, K. Plemmons, E. Wilson, A. Fleischauer

Background: Approximately 80% of reported *Legionella* infections are caused by *Legionella pneumophila* serogroup 1, the serogroup identified through urinary antigen testing (UAT). On August 18, 2021, the North Carolina Division of Public Health was notified of a respiratory illness outbreak at an adult basketball camp and investigated with local university and public health partners to determine the cause and mitigate spread of disease.

Methods: We interviewed campers, travel partners, and camp staff about symptoms and obtained diagnostic test results from campers and their clinicians. An email survey sent to attendees collected lodging, camp activity, and water exposure information. Cases were defined by any self-reported respiratory or gastrointestinal symptoms without alternative cause with onset during August 11–23 in persons using camp facilities during August 11–15. Respiratory specimens were collected for polymerase chain reaction (PCR) and culture testing. We performed an environmental assessment of camp

facilities. Pool, ice machine, faucet, and hot tub water samples were cultured. Recovered isolates were sent to CDC for further analysis.

Results: Among the 150/223 solicited respondents, 91 (41%) reported symptoms; 4 were hospitalized and none died. Time spent in the pool room (odds ratio [OR]: 13.3; 95% CI: 4.8–36.5) and small adjoining room (OR: 9.8; 95% CI: 3.5–27.6) were associated with symptoms. None had a positive UAT for *Legionella pneumophila* serogroup 1. Nine of 11 respiratory samples were PCR-positive for non-pneumophila *Legionella*. The environmental assessment identified a recently fixed jet in the associated hot tub and nonfunctional air circulation system in the pool room. The hot tub sampling yielded *Legionella micdadei*.

Conclusions: Non-pneumophila legionellosis outbreaks are difficult to identify because they are not identified by UAT and require collection of lower respiratory specimens for confirmation. Appropriate maintenance of hot tubs and water systems is crucial to prevention of all forms of legionellosis.

2:10

Acanthamoeba Infections: More Than Meets the Eye — United States, 1955–2020

Authors: Julia C. Haston, S. Kum, M. Gleason, S. Roy, I. Ali, J. Cope

Background: *Acanthamoeba* are free-living amoebae known to cause several distinct types of disease. While isolated keratitis most often occurs in healthy persons, *Acanthamoeba* can also cause severe disease affecting the central nervous system, skin, sinuses, and other organs, particularly in immunocompromised individuals. These rare severe infections are often fatal yet incompletely described. We aimed to describe patients with non-keratitis *Acanthamoeba* infections in the United States and examine factors associated with survival.

Methods: We described demographic and clinical characteristics of all patients with confirmed non-keratitis *Acanthamoeba* infections between 1955 and 2020. Patients included in this study were either reported to CDC's Free-Living Ameba program or identified in published case reports. Disease presentation was classified based on confirmatory testing and clinical presentation. Chi square and Fisher's exact tests were used to determine associations between patient and disease characteristics and survival.

Results: Of 172 patients identified, 70% were male and the median age was 44 years (range 0–87). Only 26 (15%) survived. Nearly all patients (87%) had at least one immunocompromising condition, commonly HIV (38%), cancer (27%), and solid organ or hematopoietic stem cell transplant (27%). Potential exposures included soil (11%), water (11%), and nasal irrigation (5%). Granulomatous amoebic encephalitis (GAE) was the most common disease presentation, affecting 122 (71%) patients. Other common sites of infection included skin (45%), sinuses (30%), lungs (13%), and bone (6%). Many patients (47%) had confirmed or suspected involvement of more than one body site. Survival was less frequent among those with GAE ($P < .001$) and more frequent among those with cutaneous disease ($P = .006$).

Conclusions: Non-keratitis *Acanthamoeba* infections occur primarily in immunocompromised individuals and are usually fatal. Survival may be associated with disease presentation. Providers who care for at-risk patients should be aware of the various disease manifestations to improve early recognition and treatment.

Authors: Shanna Miko, S. Collier, A. Andujar, K. Benedict, C. Burns-Lynch, J. Haston, J. Cope

Background: Seven million waterborne-related infections occur in the US each year. Tap water that is safe to drink is not sterile. When used for medical purposes (e.g., nasal rinsing) unsterile tap water can result in infections from high consequence waterborne pathogens like nontuberculous mycobacteria and free-living amebae. We examined population perceptions of water sterility and use of water at home.

Methods: Porter Novelli Public Services and ENGINE Insights administered the PN View 360+ survey (August 2021, n = 1,004 US panel members aged ≥18 years). The survey was weighted to be representative of the U.S. population by gender, age, region, race/ethnicity, and education. We used weighted SAS survey procedures to assess proportions of response variables by demographics. We tested associations of responses with demographic variables using Chi-square tests and used post hoc Wald F tests to compare subgroups for demographic variables with more than two levels.

Results: Most respondents (62.9% (95% CI: 59.8–66.1)) answered that “sterile water” means absence of bacteria or living organisms, 32.9% (30.0–36.2) agreed tap water does not contain bacteria or organisms, and 26% (23.1–28.9) answered that water filters sterilize water. More than half (62.4% (58.9–65.8)) agreed tap water could safely be used for sinus rinsing, 50.1% (46.5–53.6), for rinsing contact lenses, and 41.5% (37.9–45.1), for filling medical respirator devices and humidifiers. When asked about usage, 24% (21.2–26.8) reported filling respiratory devices, 12.7% (10.6–14.9) rinsed their sinuses, and 8.9% (7.0–10.7) rinsed their contact lenses with tap water.

Conclusion: Tap water is commonly misperceived to be sterile and used for home medical purposes. Clear messaging and educational campaigns could improve public knowledge and help healthcare providers communicate recommendations. Improved communications and awareness may help reduce high consequence infections associated with non-sterile water for home medical uses.

SESSION L: Late-Breaking Reports

3:20–4:25 pm

Moderators: Debra Houry and Eric Pevzner

3:25 Transmission of Yellow Fever Vaccine Virus Through Blood Transfusion and Solid Organ Transplantation — United States, 2021

Authors: Raymond A. Soto, R. Free, J. Bhatnagar, P. Annambhotla, J. Lehman, J. Velez, A. Panella, K. Fitzpatrick, A. Brault, H. Hughes, J. Ritter, S. Reagan-Steiner, N. Rassaei, R. Martinez, S. Basavaraju, E. Staples, C. Gould

Background: In November 2021, CDC was notified of four solid organ transplant (SOT) recipients who developed unexplained neurologic symptoms 2–6 weeks following transplantation of organs from a common donor. Metagenomic next-generation sequencing of cerebrospinal fluid (CSF) from one recipient identified a single, 106-base pair, read of yellow fever (YF) virus. An investigation was initiated to confirm the finding and identify the potential source of infection.

Methods: We reviewed donor and recipient medical histories and tested clinical and pathologic specimens for evidence of YF viral RNA, antigen, and antibodies. We initiated a blood traceback investigation to assess blood transfusion as a possible source of infection.

Results: Four patients received organs (heart, liver, kidneys) from the common donor. All four recipients developed a febrile

prodrome followed by neurologic symptoms; three developed severe encephalitis and one died. No YF viral RNA or antigen was detected in recipient CSF, serum, or organ tissue biopsies, or in archived donor serum. Autopsy brain tissue from the heart recipient was positive for YF viral RNA by RT-PCR, and Sanger sequencing of amplicons indicated highest identity with YF vaccine strain. Three recipients had evidence of seroconversion with YF virus IgM and neutralizing antibodies post-transplant; the heart recipient lacked adequate samples for testing. Two days before organ procurement, the organ donor received red blood cells from a donor who received YF vaccine 6 days before blood donation.

Conclusions: Transmission of YF vaccine, a live, attenuated viral vaccine, by SOT resulted in neurologic disease in four recipients. The source of infection was a recently vaccinated blood donor, despite potential blood donors being screened for vaccination before donation. Blood donors should be counseled about answering pre-donation screening questions accurately and the need to defer blood donation after receipt of live vaccines, such as YF.

3:35

Provider Access to and Coverage of Pediatric COVID-19 Vaccine for Children ages 5–11 years — United States, November 2021–January 2022

Authors: Christine Y. Kim, R. Yee, R. Bhatkoti, D. Carranza, D. Henderson, T. Vogt, Z. Smith, C. Duggar, K. Chatham-Stephens, C. Ottis, K. Rand, T. Lim, A. Jaffe, R. Lubitz, R. Hayes, S. Kuwabara, J.P. Trinidad, S. Radesky, A. Cohen, P.N. Kelleher, A. Guo, S.K. Pillai, A. Patel

Background: On October 29, 2021, the Pfizer-BioNTech pediatric COVID-19 vaccine was authorized for emergency use for 28 million children ages 5–11 years. To optimize country-wide access to vaccine, the existing Vaccines for Children (VFC) program providers and non-VFC medical providers were augmented with pharmacies. We aimed to understand COVID-19 vaccine access and coverage by the CDC/ATSDR Social Vulnerability Index (SVI) and provider type to inform ongoing vaccination efforts and COVID-19 vaccination planning and implementation for children ages <5 years.

Methods: We used COVID-19 vaccine administration data reported to CDC and 2019 U.S. Census Bureau population estimates. We conducted descriptive and geospatial analyses to estimate the number of active pediatric COVID-19 vaccine providers (received shipment/administered 1+ dose the past

28 days or reported any inventory the past seven days), the proportion of children within five miles of a provider, and coverage for first and second doses administered.

Results: By four weeks of the COVID-19 vaccination program for ages 5–11 years, 38,732 providers (53% in high SVI areas) administered 4.3 million first doses, achieving 15% first dose coverage (11% in high vs. 18% in low SVI). By 11 weeks, 7.9 million first doses were administered, achieving 28% first dose coverage (21.3% in high vs. 29.5% in low SVI areas). Overall, and in high SVI areas, 92% of children ages 5–11 years lived within five miles of a provider.

Conclusions: Initial limited vaccine supply was strategically distributed across high and low SVI areas, especially pharmacies, to reach children ages 5–11 years. Vaccination rates at 11 weeks remained low and were lower in high SVI areas. Additional strategies are needed to ensure vaccine access for children ages <5 years since pharmacists are limited to vaccinating children ages ≥3 years, and to improve coverage for children ages 5–11 years overall.

3:45

Lessons from the Field: A More Granular Assessment of Gender, Race, Ethnicity, and Language — Louisiana, 2021

Authors: Kristin J. Marks, A. Omari, A. Foreman, A. Troeschel, C. Duhé, C. Maser, E. Fechter-Leggett, G. Chew

Background: The Office of Management and Budget (OMB) specifies minimum standards, a set of predefined questions and response options, for reporting demographics from federal data collections. However, nonfederal (e.g., state, local, tribal) public health authorities have the flexibility to deviate from OMB data standards during investigations. To guide future data collections, we describe responses captured during a field investigation that used more precise demographic questions than OMB's expanded options.

Methods: We surveyed 307 individuals at home improvement stores, farmers markets, and work sites during December 4–14, 2021, among areas of Louisiana affected by Hurricane Ida. Demographic questions were asked at the end of the survey. Unlike OMB minimum standards, demographic questions were open-ended to allow write-in responses. Interviewers matched participants' answers to preset categories for gender, race, and ethnicity, when possible, or wrote in responses. Language questions had no preset categories. We summarized participant

responses by using percentages and described qualitative interviewer observations.

Results: Overall, 189/307 individuals identified as male (62%) and 110/307 as female (36%); 21% reported speaking a language other than English at home. Some participants reported gender or race that would not have been captured by the OMB minimum standards, including 1% who reported nonbinary gender, 1% who did not report gender, and 3% who reported race as Hispanic or Latino. Some participants reacted negatively to being asked their gender, race, ethnicity, or language, and one stopped participating because of it. However, some participants responded positively to more inclusive options.

Conclusions: Open-ended demographic questions captured more specific participant race and gender identities that differed from OMB minimum standards; such data can be used to gain a deeper understanding of local communities to help tailor public health messages or interventions and address health equity. De-escalation training is recommended for interviewers, who might encounter negative reactions from participants.

3:55

Outbreak of SARS-CoV-2 Omicron Variant at a Wisconsin Wedding, November 2021

Authors: Hannah E. Segaloff, C. Stainken, J. Wiegand, L. Page, K. Mosack, A. Bauer, M. Khubbar, N. Balakrishnan, D. Wadford, N. Moss, E. Dunne, A. Goeldner, I. Pray, M. Lambert, S. Gibbons-Burgener, D. O'Connor, S. Bhattacharyya, K. Johnson, R. Westergaard, W. Chung

Background: The SARS-CoV-2 Omicron variant was identified on November 24, 2021. On December 2, the California Department of Public Health notified the Wisconsin Department of Health Services of six California residents infected with SARS-CoV-2 with S-gene target failure by reverse-transcription polymerase chain reaction (RT-PCR), later confirmed on December 3 as Omicron, who attended a late-November wedding in Wisconsin.

Methods: Wedding attendees were identified and interviewed to assess demographic and clinical characteristics. Testing results and vaccination status were obtained through record review. Samples were obtained when possible and sequenced. Characteristics between attendees testing negative and positive on a SARS-CoV-2 RT-PCR or antigen test were compared using chi-square tests.

Results: Of 169 wedding attendees, 80 were interviewed, 73 were tested for SARS-CoV-2, and 39 tested positive. Thirty-one of 35 (88.6%) interviewed positive attendees were symptomatic; none were hospitalized. Median incubation period was 2 days (interquartile range: 2–3 days). The index patient, who received a Pfizer booster dose 6 weeks prior, returned from international travel on the wedding day. In addition to the index case, 35 of 39 (89.7%) positive attendees and 27 of 34 (79.4%) negative attendees were fully vaccinated or fully vaccinated with a booster ($p = 0.22$). Previous SARS-CoV-2 infection was more frequent among those testing negative ($n = 9$, 26.5%) than positive ($n = 3$, 7.7%) ($p = 0.03$). Among a subset of 39 wedding attendees interviewed about reception behaviors, frequent mask wearing was more common among attendees testing negative (16/24, 66.7%) compared with attendees testing positive (5/15, 33.3%) ($p = 0.04$).

Conclusions: This investigation of an early Omicron variant outbreak in the U.S. revealed high transmissibility and infections occurring among fully vaccinated persons. The multistate nature of this outbreak and critical role of laboratory results highlights the importance of strong epidemiology and laboratory partnership across jurisdictions.

4:05

Acute Health Impacts Associated with Petroleum Contamination of the Joint Base Pearl Harbor-Hickam Water System — Oahu, Hawaii, November 2021

Authors: Amanda Smith, V. Parasram, A. Troeschel, A. Poniatowski, S. Miko, K. Surasi, A. Cavanaugh, M. Bolduc, M. Jarvis, N. Mintz, C. Edge, D. Felton, R. Funk, B. Gerhardstein, M.F. Orr

Background: In November 2021, a reported 14,000 gallons of jet fuel and water leaked from the Red Hill fuel storage facility, contaminating a water system serving 93,000 people on Oahu, Hawaii. Beginning November 28, 2021, complaints of illness and a fuel-like odor from residents' tap water were reported to the Hawaii Department of Health (HDOH). Water sampling of the affected area found evidence of petroleum hydrocarbons. Acute symptoms caused by petroleum exposure include rashes, cough, diarrhea, headache, fatigue, and anxiety. The Agency for Toxic Substances and Disease Registry conducted an Assessment of Chemical Exposures (ACE) Epi-Aid to better understand the acute health impacts experienced following the incident.

Methods: During January 7–February 10, 2022, we administered a survey adapted from the ACE toolkit to people aged ≥ 18 years who lived, worked, or attended school in the affected area. Parents were asked to complete the survey for

children. This survey was administered in-person, by phone by a trained interviewer, or self-administered online and assessed acute health symptoms. A convenience sample was recruited through in-person (e.g., water distribution sites, schools, medical clinics, and businesses) and digital (e.g., Facebook) outreach.

Results: Of 2,314 participants, 86% reported experiencing at least one new or worsening symptom since November 20, 2021, and 87% of symptomatic participants ($N = 1,617$) reported symptom improvement after switching to an alternate water source. Notable reported symptoms included: headache (57%), fatigue (44%), or dizziness (38%); dry, itchy skin (50%), rash (40%) or skin irritation/burning (37%); diarrhea (49%) or nausea (40%); and anxiety (37%). Further, $>30\%$ of participants that reported headache, dry/itchy skin, or fatigue indicated those symptoms persisted for 30 days or more.

Conclusions: Many participants reported symptoms consistent with petroleum exposure; some persisting for ≥ 30 days. Recommendations include a need for health provider education, mental health support, and follow-up investigations.

Authors: AdeSubomi O. Adeyemo, S. Montgomery, R. Chancey, P. Annambhotla, J. Coyle

Background: Infection with the soil-transmitted parasite *Strongyloides stercoralis* can cause severe complications among organ transplant recipients. Not all organ procurement organizations (OPOs) test solid organ donors for strongyloidiasis. In December 2021, an OPO was notified of potential donor-derived infection in a right kidney recipient with strongyloidiasis confirmed 102 days posttransplant. The Organ Procurement and Transplantation Network Ad Hoc Disease Transmission Advisory Committee (DTAC) was notified of the possible event. CDC accepted the case for investigation to determine infection source.

Methods: CDC contacted the OPO to confirm the status of other organs from the donor and obtain donor history and testing results; state health departments were notified of the investigation. To determine donor infection status, the OPO submitted a specimen for *Strongyloides* antibody testing. Transplant coordinators were interviewed about recipient *Strongyloides* testing, treatment, and risks. The DTAC case classification was used to determine case status.

Results: The organ donor emigrated from a strongyloidiasis endemic region and worked in landscaping; the banked specimen tested positive for *Strongyloides* antibodies. The right kidney recipient was serologically negative pretransplant. She had gastrointestinal symptoms 98 days posttransplant. Small bowel and stomach biopsies revealed *Strongyloides* infection. The left kidney and heart recipients were not screened pretransplant. The left kidney recipient was born in an endemic region, resides in a rural area, and had no clinical illness compatible with strongyloidiasis; two posttransplant *Strongyloides* antibody tests were negative. The heart recipient had no known risks; bronchoalveolar lavage revealed *Strongyloides* infection. She developed disseminated strongyloidiasis and hyperinfection syndrome 131 days posttransplant. Based on results, donor-derived strongyloidiasis was proven in two of three recipients.


Conclusions: Testing donors whose histories suggest strongyloidiasis risk can help prevent donor-derived infections. Although testing donors for strongyloidiasis is not currently standard for all OPOs, increased testing can improve patient outcomes through early detection and treatment.

PRESENTATION OF AWARDS

4:25–4:35

Presenter: Danice Eaton

- Anne Schuchat Distinguished Friend of EIS Award
- Donald C. Mackel Memorial Award
- J. Virgil Peavy Memorial Award
- Paul C. Schnitker International Health Award
- Iain C. Hardy Award
- James H. Steele Veterinary Public Health Award
- Mitch Singal Excellence in Occupational and Environmental Health Award
- Shalon M. Irving Health Equity Award

 *Awards presented during session.*

CLOSING REMARKS

4:35–4:45 pm

Presenter: Patricia Simone

THURSDAY

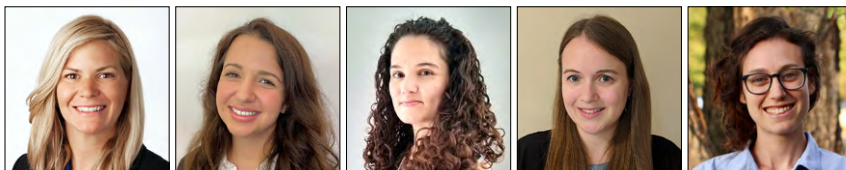
EIS Officers, Class of 2020



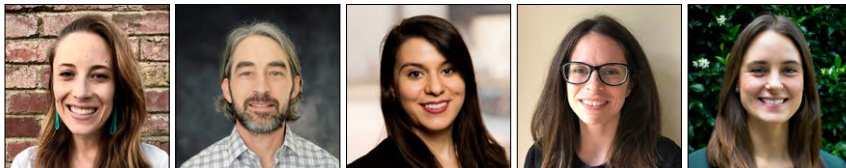
Abbott, Andrew, MD, MPH, BS – CDC CGH
 Agathis, Nickolas, MD, MPH, BA – CDC NCIPCDVP
 Atherstone, Christine, PhD, MSc, BA – CDC CGH
 Bart, Stephen, PhD, BS – Connecticut DPH
 Bigouette, John Paul, PhD, MPH, MS, BS – CDC CGH



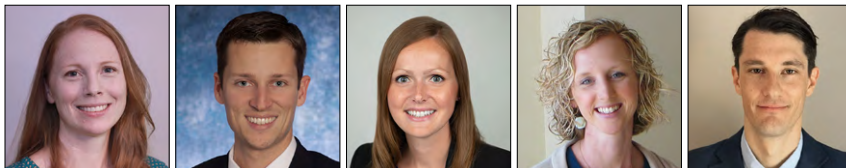
Bolduc, Michele, PhD, MA, AB – OMHHE
 Bonacci, Robert, MD, MPH, BS, BA – CDC NCHHSTP
 Bonner, Kimberly, PhD, MPA, BA – Oregon PHD
 Brihn, Auguste, BVM&S, MPH, BA – Los Angeles County DOH
 Britton, Amadea, MD, SM, AB – CDC NCIRD



Cavanaugh, Alyson, PhD, DPT, MPH, BS – Kentucky DPH
 Dale, Ariella, PhD, MPH, BS – Maricopa County DPH
 and Arizona DHS
 DeCuir, Jennifer, PhD, MD, BS – CDC CGH
 Delahoy, Miranda, PhD, MSPH, BA – CDC NCIRD
 Deutsch-Feldman, Molly, PhD, ScM, BA – CDC NCHHSTP



Donnelly, Marisa, PhD, BS – California DPH
 Ehlman, Daniel, ScD, MPH, BA – CDC NCIPCDVP
 Firestone, Melanie, PhD, MPH, BS – Minnesota DOH
 Ford, Laura, PhD, MPH, BA – CDC NCEZID
 Franc, Katherine, DVM, MPH, BSc – CDC NCEZID



Gettings, Jenna, DVM, MPH, BS – Georgia DPH
 Golden, Thomas, MD, MPH, BA – CDC NCCDPHP
 Grome, Heather, MD, MPH, BS – Tennessee DOH
 Haston, Julia, MD, MSc, BS – CDC NCEZID
 Hernandez-Romieu, Alfonso, MBBCh, MPH – CDC NCEZID



Hershaw, Rebecca, PhD, MSPH, BA – CDC NCHHSTP
 Hudson, Matthew, MD, MPH, BA – CDC NCEZID
 Janssen, Julia, MD, BA – CDC CGH
 Kim, Christine, PhD, MSPH, BA – CDC NCHS
 Konkle, Stacey, PhD, MPH, BS – New York State DOH

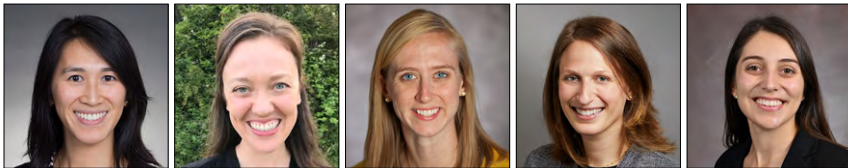


Kunkel, Amber, ScD, BA – CDC NCEZID
 Li, Ruoran, ScD, MPhil, BA – CDC NCEZID
 Mac, Valerie, PhD, MS, BSN, NP-C – US Virgin Islands DOH
 Magleby, Reed, MD, BS – New Jersey DOH
 Mahale, Parag, PhD, MBBS, MPH – Maine Center for
 Disease Control

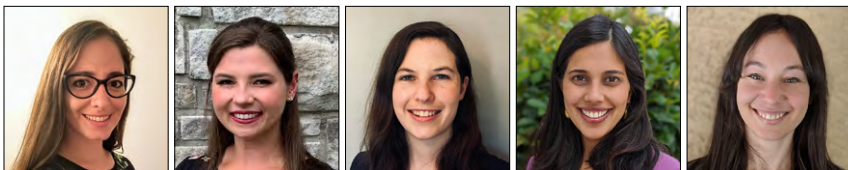
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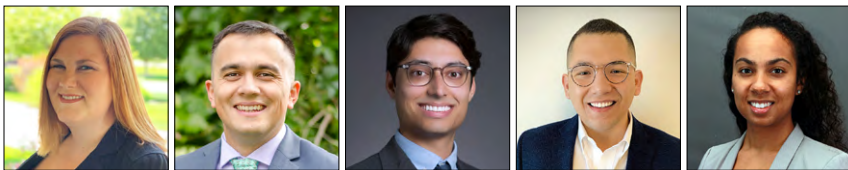
Malden, Deborah, DPhil, MSc, BSc – Kaiser Permanente Southern California
 McCormick, David, MD, MPH, BA – CDC NCEZID
 Miller, James, MD, MPH, AB – Washington State DOH
 Moline, Heidi, MD, MPH, BS – CDC NCIRD
 Murray, Meghan, PhD, MPH, BS, BA – Pennsylvania DOH



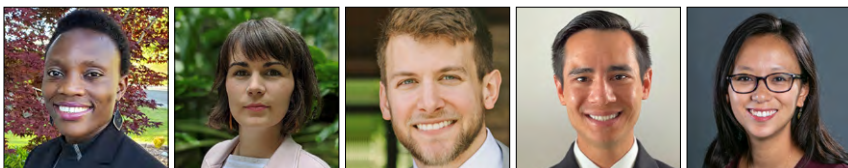
Nakayama, Jasmine, PhD, BSN – CDC NCCDPHP
 Peebles, Kathryn, PhD, MPH, BA – New York City DOHMH
 Pratt, Caroline, MSN, MPH, BSN, BA – CDC NCEZID
 Rosenblum, Hannah, MD, BA – CDC NCIRD
 Ruff, Jeanne, MSN, MPH, Bsnrs – Southern Nevada Health District



Sadigh, Katrin, MD, BA – CDC CGH
 Schmitt-Matzen, Emily, DVM, MPH, BS – Florida DOH
 Segaloff, Hannah, PhD, MPH, BS – Wisconsin DOH Services
 Shah, Melisa, MD, MPH, AB – CDC NCIRD
 Shragai, Talya, PhD, BS, BA – CDC CGH



Smith, Amanda, PhD, MPH, BS – CDC CSELS
 Soto, Raymond, PhD, MScPH, BS – CDC NCEZID
 Surasi, Krishna, MD, MPH, BS – California DPH
 Teran, Richard, PhD, MPH, BS – Chicago DPH
 Van Dyke, Miriam, PhD, MPH, BS – CDC NCIPCDVP



Wanga, Valentine, PhD, MS, BS – CDC NCBDDD
 Whitehill, Florence, DVM, MPH, BA – CDC NCEZID
 Wilson, W. Wyatt, MD, MSPH, BA – CDC NCEZID
 Wong, Joshua, MD, BA – CDC NCEZID
 Wu, Karen, DVM, MSPH, BS – CDC NCEZID

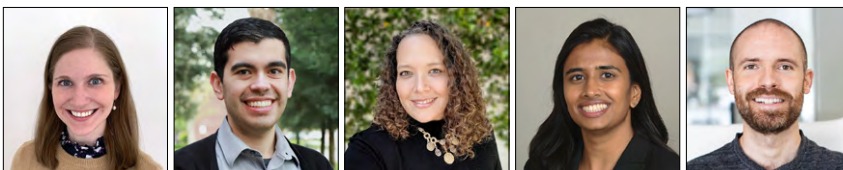
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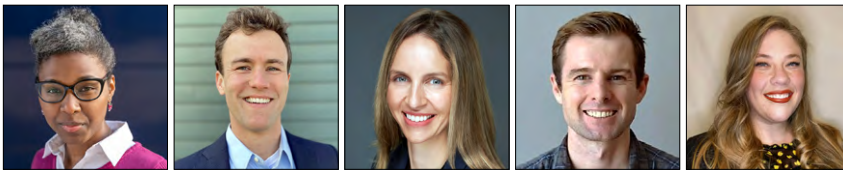
Accorsi, Emma, PhD,BS – CDC NCIRD
 Adeyemo, AdeSubomi, PharmD, MPH, BS – CDC CGH
 Ahmed, Munir, PhD, MPH, M.B.B.S. – Texas DSHS
 Allen, Sophie Jones, PhD, MSc, BSc – CDC NCEZID
 Baker, Julia, PhD, MPH, BS – CDC NCIRD



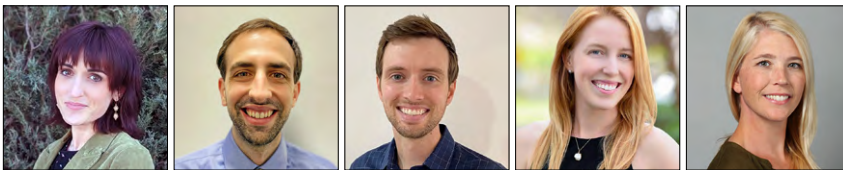
Battle, Shanice, PhD, MPH, BS – CDC OMHHE
 Beeson, Amy, MD, AB – CDC NCEZID
 Bertumen, J Bradford, MD, MPH – California DPH
 Borah, Brian, MD, MA, BA – Vermont DOH
 Bornstein, Ethan, MD, BA – Northwest Portland Area IHB



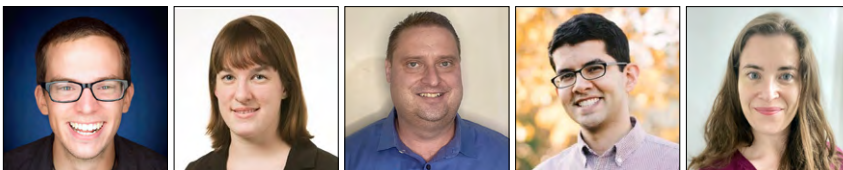
Cahill, Megan, PhD, MPhil, BS – Idaho DPH
 Carranza, David, PharmD, BA – CDC NCHS
 Castro, Laura, DrPH, MPH, BA – CDC CGH
 Choudhary, Rewa, MD, MPH, BSE – CDC CGH
 Cornforth, Daniel, PhD, MS, BS – CDC CSELS



Davis, Bionca, MPH, MN, BS, BA – CDC NCEZID
 DeJonge, Peter, PhD, MPH, BSc – Wisconsin DOHS
 Dulski, Theresa, MD, MPH, BS – Arkansas DOH
 Ederer, David, PhD, MPH – CDC NCCDPHP
 Eilers, Braiden, MD, MPH, BS, BA – CDC CGH



Fagre, Anna, DVM, PhD, MPH, BA – CDC NCEZID
 Filardo, Thomas, MD, BA – CDC NCHHSTP
 Gosdin, Lucas, PhD, MPH, BA – CDC NCBDDD
 Griffin, Isabel, PhD, MPH, BA – CDC NCEZID
 Habrun, Caroline, DVM, MPHTM, BS – CDC NCEZID

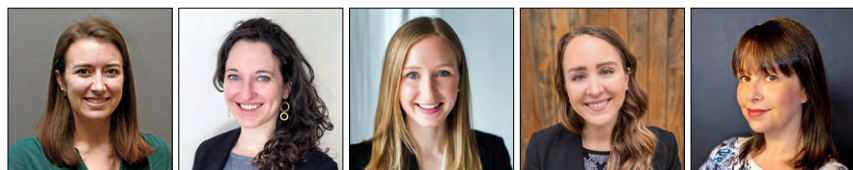


Hedman, Hayden, PhD, BA – South Dakota DOH
 Jansen, Lauren, MD, MPH, BS – Nebraska DOHHS
 Kacka, Michael, MD, MPH, BS – Colorado DPHEd
 Khan, Mohammed, PhD, MSPH, BA – CDC NCEZID
 Kreuze, Molly, DVM, MPH, BA – Maryland DOH

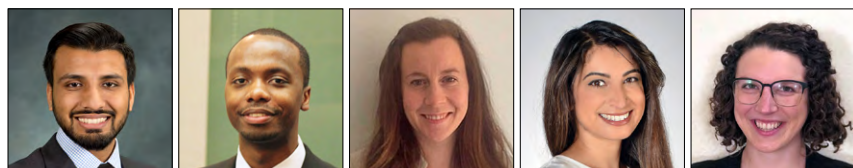


Kyaw, Nang Thu Thu, PhD, MPH – New York City DOHMH
 Lambrou, Anastasia, PhD, MSc, BSc – CDC NCIRD
 Lammie, Samantha, MD, MPH, BA – CDC CGH
 Layde, Mary, MPH, BSN – CDC CGH
 Malenfant, Jason, MD, MPH, BS – CDC NCEZID

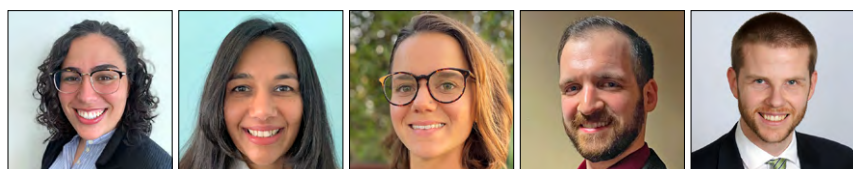
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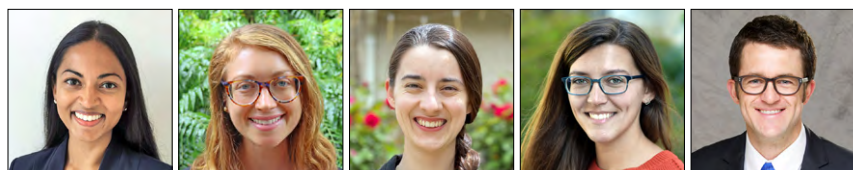
Marks, Kristin, PhD, MPH, BA – CDC NCCDPHP
 Masters, Nina, PhD, MPH, AB – CDC NCIRD
 McNamara, Kiara, DNP, BSN – CDC NCEZID
 Meeker, Jessica, PHD, MPH, BS – CDC NCCDPHP
 Miko, Shanna, DNP, MPH, MSN, BSN – CDC NCEZID



Minhaj, Faisal, PharmD – CDC NCEZID
 Muhoza, Pierre, PhD, MPH, MS, BS – CDC CGH
 Newell, Katherine, DPhil, MPH, BS – Alaska DOHSS
 Ogale, Yasmin, PhD, MSPH, BA – CDC NCHHSTP
 Ohlsen, Elizabeth, MD, BS – San Diego CHD and
 CDC NCEZID



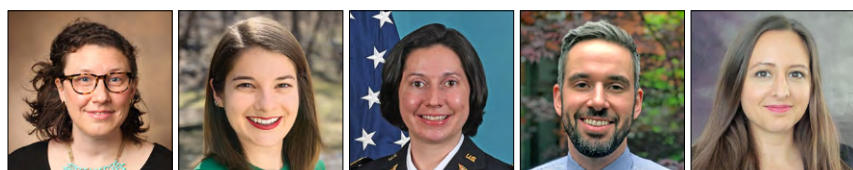
Omari, Amel, PhD, MPH – CDC NIOSH
 Parasram, Vidisha, DrPH, MPH, BA – CDC NIOSH
 Petras, Julia, MSPH, BSN – CDC NCEZID
 Pfeiffer, Jack, PhD, MS – Utah DOH
 Philpott, David, MD, MPH, BS – CDC NCHHSTP



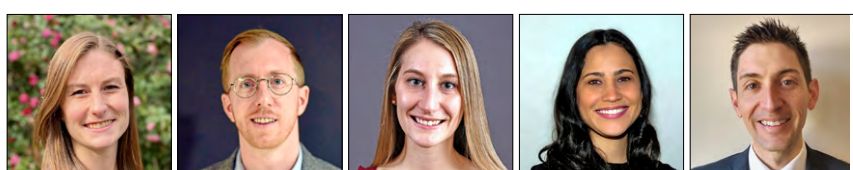
Prasad, Namrata, PhD, MPH, BSc – CDC NCIRD
 Rachlin, Audrey, PhD, MSc, BSc – CDC CGH
 Ricketts, Erin, MD, BS – North Carolina DPH
 Roskosky, Mellisa, PhD, MSPH, BS – Public Health –
 Seattle and King County
 Schultz, Jonathan, MD, MPH, BS – CDC CGH



Sekkarie, Ahlia, PhD, MPH, BS – CDC NCCDPHP
 Shi, Dallas, PhD, MD, MBA, MOH, BA – CDC NIOSH
 Siu, Allison, DVM, MPH, BS – Wyoming DOH
 Smith, Dallas, PharmD – CDC NCEZID
 Solanky, Dipesh, MD, BS – CDC NCEZID

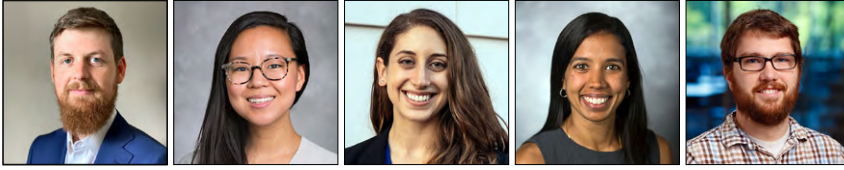


Spencer, Hillary, MD, MPH, BA – Chicago DPH
 Stadelman, Anna, PhD, MPH, BS – New Mexico DOH
 Stager, Christan, DVM, BS, BS – CDC NCEZID
 Stalter, Randy, PhD, MPH, BS – Washington State DOH
 Stewart, Andrea, PhD, BA – CDC NCCDPHP



Sumner, Kelsey, PhD, MSPH, BS, BA – CDC NCIRD
 Tori, Marco, MD, MSc, BA – South Carolina DOHEC
 Troeschel, Alyssa, PhD, MPH, BS – CDC NCEH
 Vega Ocasio, Denisse, PhD, MPH, BS – CDC NCEZID
 Webber, Bryant, MD, MPH, BA – CDC NCCDPHP

LLS Fellows, Class of 2020

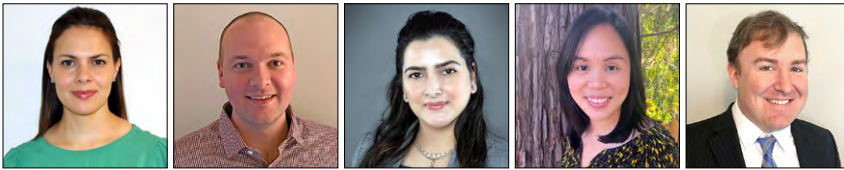


LaVoie, Stephen, PhD – CDC NCEZID
 Lee, Christine, PhD – CDC NCEZID
 Mitchell, Kaitlin, PhD, MPH – CDC CGH
 Natrajan, Muktha, PhD, MPH – CDC NCIRD
 Payne, David, PhD – District of Columbia DFSPHL



Prince-Guerra, Jessica, PhD – CDC NCIRD

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Baird, Nicolle, PhD – CDC NCEZID
 Kopping, Erik, PhD – New York City DOHMH
 Mustafa, Gul Mehnaaz, PhD, MSc – CDC NCIRD
 Ty, Maureen, PhD, MSc – Dallas CHHS
 Wakeman, Brian, PhD – CDC NCEZID

Acronyms

CDC	Centers for Disease Control and Prevention
CGH	Center for Global Health
CHD	County Health Department
CHHS	County Health and Human Services
DFSPHL	Department of Forensic Sciences Public Health Laboratory
DOH	Department of Health
DOHS	Department of Health Services
DOHEC	Department of Health and Environmental Control
DOHMH	Department of Health and Mental Hygiene
DOHSS	Department of Health and Social Services
DPH	Department of Public Health
DPHED	Department of Public Health and Environment
DSHS	Department of State Health Services
IHB	Indian Health Board
NCEH	National Center for Environmental Health
NCEZID	National Center for Immunization and Respiratory Diseases
NCHHSTP	National Center for HIV, Viral Hepatitis, STD, and TB Prevention
NCHS	National Center for Health Statistics
NCIPCDVP	National Center for Immunization and Respiratory Diseases and Control Division of Violence Prevention
OMHHE	Office of Minority Health and Health Equity
PHD	Public Health Department

Incoming EIS Officers, Class of 2022

Adams, Carly, PhD, MPH
Alarcon, Jemma, MD, MPH
Alishahi, Musheng, PhD, MSc
Balasuriya, Lilanthi, MD, MHS, MMS
Bastani, Parsa, PhD, MA
Beron, Andrew, PhD, MPH
Berry, Isha, PhD, MSc
Besera, Ghenet, PhD, MPH
Blackburn, Dawn, BVMS, MSc
Bratcher, Anna, PhD, MSPH
Burr, Kathryn, DVM, MPH
Byrd, Katrina, MD, MS
Calloway, Kimberly, DVM, MPH
Carpenter, Ann, DVM, MPH
Cash-Goldwasser, Shama, MDCM, MPH
Chapman, Kelly, PhD, MA, MPH
Cholli, Preetam, MD
Choudhury, Asha, MD, MPH, MS
Claridy, Mechelle, PhD, MPH
Connolly, Sarah, PhD, MPH
Crisp, Carolyn, PhD, MPH
Crockett, Haillie, DVM, MPH
Deida, Axel Vazquez, PharmD, MPH
Diallo, Alpha Oumar, PhD, MPH
Dulcey, Melissa, DVM, PhD
Esie, Precious, PhD, MPH
Faherty, Emily, PhD, MA
Fazal, Amara, MD
Field, Eleanor, PhD, MS
Fothergill, Amy, PhD, MPH
Gichuhi, Beatrice, DNP, MN
Grossman, Marissa, PhD, MPH
Hamid, Sarah, PhD, MPH
Hamlet, Arran, PhD, MSc
Hanley, Allison, HsD, MHS
Haque, Sabrina, PhD, MPH
Hennessee, Ian, PhD, MPH
Huynh, Cam-Van, DDS, MPH
Innes, Gabriel, VMD, PhD
Johnson, Oshea, PhD, MA
Jones, Forrest, PhD, MPH
Kagima, Barbara, PhD, MS
Kahn, Rebecca, PhD, SM
Kaur, Gurpreet, MD, MPH

Kava, Christine, PhD, MA
Kojima, Noah, MD
Labgold, Catherine, PhD, MPH
Lamar, Frederica, PhD, MSPH
Lamb, Gabriella, MD, MPH
Lamere, Elizabeth, BSN, MPH
Lee, Scarlett, DVM, PhD
Lindsay, Keisha, PhD, MA
Ma, Kevin, PhD
Madera-Garcia, Valerie, PhD, MPH
McArdle, Cristin, PhD, MPH
McKinnon, Izraelle, PhD, MPH
Mitchell, Cedar, PhD, MSPH
Nam, Yoon-Sung, PhD, MPH
Nguyen, Daniel, PhD, MScPH
Noiman, Adi, PhD, MHS
Odafe, Solomon, MBBS, MPH, MS
Penney, Jessica, MD, MPHTM, MS
Price, Emma, VMD, MS
Proctor, Dylan, PhD, MA, MS
Quader, Zerleen, PhD, MPH
Rich, Shannan, PhD, MS
Rovzar, Corey, DPT, PhD
Rowh, Adam, MD
Saunders, Katharine, DNP, MPH
Schember, Cassandra, PhD, MPH
Schildknecht, Kimberly, SnD, BSN, MPH
Seifu, Leah, MD, MPH
Sharpe, Joyce (Danielle), PhD, MS
Shelus, Victoria, PhD
Slocum, Elizabeth, PhD, MPH
Sodeke, Olutomi, MD
Stefanos, Ruth, MD, MPH
Stephenson, Caroline, PhD, MS
Tan, Marissa, DO, MA
Thomas, Christine, DO, MPH
Tiller, Elizabeth, MPH, MS
Vos, Saskia, PhD, MPH
Wallender, Erika, MD
Weng, Xingran, DrPH, LLB, MSW
White, Elizabeth, PhD
Wolf, Maren, BSN, MPH
Wondmeneh, Sarah, PhD, MPH
Zielinski, Lindsay, DO, MPH

Incoming LLS Fellows, Class of 2022

Bell, Courtnee, BS, MS, PhD

Bouda, Emilie, AS, BA, PhD

Burg, Noah, AA, BA, PhD

Callaway, Perri, BA, PhD

Darby, Trevor, BSc, MSc, PhD

Dumoulin, Peter, BSc, PhD

Gianetti, Brittany, BS, MPH, PhD

Leachman, Jacqueline, BS, PhD

Martin, Matthew, BS, MS, PhD

Mickum, Megan, BS, PhD

Miller, Katherine, BS, MPH, PhD

Murphy, Robert, BS, PhD

Rodriguez, Sergio, BSc, MPH, MSc, PhD

Sabin, Susanna, BA, MSc, PhD

Schatzman, Sabrina, BS, PhD

Scott, Ninecia, BS, PhD

Sels, Jessica van Loben, BS, MPH, PhD

Stewart, Roxana Rodriguez, BS, PhD

Thomas, Jeronay, BS, MS, PhD

Vantucci, Casey, BS, PhD

Watts, Elizabeth, BS, PhD

Wong-Sam, Andres, MS, PhD

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